FIN.	AL REPORT
VOL	UME 2 of 2 - APPENDICES
A S	tudy of Toxic Emissions
fror	n a Coal-Fired Power
Plai	nt - Niles Station
Boil	ler No. 2
Con	tract DE-AC22-93PC93251
То	
u.s.	Department of Energy
Pitts	burgh Energy Technology Center

June 1994



FINAL REPORT

VOLUME 2 of 2 - APPENDICES

on

A STUDY OF TOXIC EMISSIONS FROM A COAL-FIRED POWER PLANT - NILES STATION BOILER NO. 2

Contract No. DE-AC22-93PC93251

Prepared for

DEPARTMENT OF ENERGY PITTSBURGH ENERGY TECHNOLOGY CENTER

by

BATTELLE
Columbus Operations
505 King Avenue
Columbus, Ohio 43201

June 1994

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APPENDIX A PROCESS DATA LOG SHEETS FROM NILES BOILER NO. 2

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM
BOILER PROCESS DATA
(Record data hourly)

Date: 07-26-93.

Time .	Initials of person	Load, MW	Furnace Outlet	Steam tem	1p., F 64 68	Drum Steam	Throttle Steam
	Recording Data		Oxygen, percent	SH Outlet	RH Outlet	Pres., psig	Flow, klb/hr
0700	20	117	1.80	1000	978	153	882
0800	JAJ.	117	1.47	1000	979	1538	881.36
0900	JAV.	117	1.3/	999	981	1535	881.75
1000	J.P.J.	117	1.56	1000	981	1534	872.83
100	4.15.	117	1.45	1000	979	1537	873.39
200	P.T.	116	1.21	1001	977	1535	873.56
1500	J.F.J.	116	1.18	1000	977	1535	875.47
1400	J.P.T.	117	1.23	1001	982	1535	877.16
700	G.P.T.	117	1.29	1000	982	1535	879.27
1400	WP.X	117	1.54	1000	985	1537	880.27
1700	WP.R	117	1.28	1000	987	1537	377.78
1800	WPR	117	1.34	1000	984	1536	876.73
.900	WPR	117	1,25	999	934	1536	881,25
:000	WPR	117	1.41	1000	984	1535	878.13
2100	WPR	לוו	1.33	1001	981	1533	876.78
		<u> </u>					

1600 Raised Jo 7536 1838

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TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA (Record data hourly)

Date: 67-26-93.

				Date:	0/26 13
Time	Initials of Person Recording Data	Total Coal Flow, klb/hr	Stack 3H SO2, ppm	Stack 3H NOx, ppm	Stack Opacity, percent
0700	P	90.0	2.16	1.27	5.1
0800	9.FJ.	90.8	2.08	1.33	3.1
0000	J.P.J.	90.9	2.14	1.30	3.1
1000	4.J.	90.8	2.23	1.27	3.1
1100	F.J.	88.9	2.06	1.29	3.1
1200	IPT.	89.2	2.05	1.25	3./
1500	J-17.	89.8	2-31	1.26	3./
1400	J.P.J.	89.8	2.23	1.26	3.1
1500	8.P.J.	90.0	2.25	1.28	3./
.00	WPR	90.1	2.27	1,32	3.0
700	WPR	88.4	2.19	1.39	3,0
1200	WPR	88.7	2.23	1.39	3.0
1900	WPR	88.9	2.25	1.35	3,0
2090	WPR	88.L	2.27	1.33	2.4
<i>⊋100</i>	WPR	39.0	2.20	1.40	2.6

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Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

7/26/93 Date: Field Bus Primary Side Time Initials of Secondary Side Person Recording Voltage, Voltage, Current, Current. Data amps kv ma 909 1000 1 A-B ef Sed Dick IT 11980) 2 49, A 200 د – 120 رد ت 2 76 В 245 .) 0) 3 250 A ر ت 300 3 В 250 110 - 3 ر-4 Α 022 4 В 48 5 Α 275 135 500 145 275 5 В 47 550 re (In ant A-B 1 1,00 2010 43 ့် ၁၁ 2 Α _ > 2 220 В <u>_</u> 1 3 A 3 В ペイ · -·-4 Α 4 В 5 Α

Project Engineer Review Review Initials/Date

5

В

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/26/93

Time	Initials of Person	Field	Bus	Primary Si	de	Secondary	<u> </u>
	Recording Data	-		Voltage, V	Current, amps	Voltage, kv	Current, ma
1400	mol	1	A-B	out	5C-12	المرابع الموا	921
		2	Α	/ b 7	30	÷ ₹	2.2
	-	2	В		70	-,1	_
		3	Α		0 -		-
		3	В	7.70	' 2	ลำ .)	·
		4	Α	sq. fi			
		4	В	رال کون			
		5	Α		_		•
V	Y	5	В	7 -	145	1	
1600	line	1	A-B	31.7 24		tages	从
		2	Α	190	20	· (1)	100
		2	В	ا مکت	70	<u> </u>	2.5
	'	3	A		5 7	-	-
		3	В		<u>-</u> j		,
		4	Α	به بس			
-		4	В	d/L			
11/	0/	5	Α	ر داید	. 7-	~ 3	
		5	В	275	1-5	43	<u>5</u> 77.0

Project Engineer Review 19/5/93
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/26/93

Time	Initials of	Field	Bus	Primary Si		Secondary	
	Person Recording Data			Voltage, V	Current, amps	Voltage, kv	Current,
1800		1	A-B	out of	servine	(tage	۸)
		2	Α	175	50	4	106
		2	В	260	כל	-	225
		3	A	260	90	- ن	
		3	В	260	9	じろ	377
		4	A	000-)	
		4	В	al!	_		->
		5	A	275	140	43	200
		5	В	280	14-	i_ i3	5-0
					7.11		
2000		1	A-B	27" OF	-640.	100	42.
		2	Α	22 =	43	47 '	120
		2	В	270	70	54	220
		3	Α	260	90	4.4	2.75
		3	В	270	105	49	300
	_	4	Α	_ زور			
		4	В	4.		- · ·	
		5	Α	a		4 3	500
		5	В	± 90	170	49	5 50

Project Engineer Review /5/9/93
Initials/Date

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM BOILER PROCESS DATA

(Record data hourly)

Date: 7/27/93

Time	Initials of person	Load, MW	Furnace Outlet	Steam tem	ip., F 6A 6B	Drum Steam	Throttle Steam
	Recording Data		Oxygen, percent	SH Outlet	RH Outlet	Pres., psig	Flow, klb/hr
5-00	NEM	116	1,72	/000	983	1537	875.14
0 900	Y898	117.0	1,44	1000	980	1534	₹74. % 0
0900	40D	116.7	1,61	1001	৭৲৭	1534	875.36
1000	SOS	116.5	170	1000	981	1535	974.SS
1100	ROD	116.3	1.64	1000	983	1234	977.20
1200	<i>RDO</i>	116.7	1.62	1000	५ ६५	1535	<u> የ</u> ጎር ካጎ
1300	ROD	117.0	140	1000	987	1537	7 79.43
1400	JR90	116.5	1.34	1000	985	1534	978.69
1500	ROD	116.5	1.46	100.	985	1533	874.88
1600	WPR	116.5	1.74	1000	987	1535	878.38
1700	WPR	116.7	1.75	1000	989	1533	878, 30
1800	WPR	114.3	1.55	1000	987	1532	877.05
1760	WPR	116.7	2.13	1000	990	1535	874.88
دده خ	WPR	116.7	1.81	1000	990	1533	875.41
				<u> </u>			
		ļ					
				·	<u> </u> 		

Project Engineer Review Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA

(Record data hourly)

		(1100011			
		6A 3A	3H	34Date:	7/27/9
Time	Initials of Person Recording Data	Total Coal Flow, klb/hr	Stack SO2, ppm	Stack NOx, ppm	Stack Opacity, percent
0700	7 Em	89,36	2.13	1,42	3, [
0400	KOB	99.0	2.14	1.41	3.1
0900	490	89,3	2.19	7.33	3.09
1000	Ree	90.3	2,23	1.36	3.09
1100	REE	90.4	a.27	1.30	3.10
1500	ROD	89.7	2.23	1.36	3.10
1300	ROD	89.8	2,59	1,41	3,10
1400	ROD	90.5	a.49	1.39	3,10
1500	4206	91.3	2.70	1.45	3. <i>5</i>
1600	WPR	72.4	2.78	1.42	3.0
1700	WPR	92.9	2.73	1.41	3.1
1200	WPR	92.8	2.76	1.34	3.0
1500	WPR	93.2	2.78	1.36	3,0
233	WPR	93.5	2.63	1.33	2.6
		<u> </u>		<u> </u>	
·					

Project Engineer Review 10/5/93
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

			.•		Da	ate: 7/2	7/95
Time	Initials of Person	Field	Bus	Primary Si	ide	Secondary	Side
	Recording Data			Voltage, V	Current, amps	Voltage, kv	Current, ma
0900	wh	1	A-B	to.	enie o.	٦	>
		2	Α	150	38	40	100
		2	В	250	70	49	220
		3	A	260	90	44	275
		3	В	260	[10	ردی	200
		4	A	-6A		-	>
		4	В	11/2		>	
		5	A	275	135	48	500
		5	В	280	145	49	1,1
[100	had	1	A-B	-	yeed or	t	
		2	Α	21-	40	50	ILO
		2	В	250	フロ	50	220
		3	Α	2.55	90	44	275
		3	В	-50	120	48	300
		4	Α	off-	275	132	
	,	4	В	app -			>
		5	Α	_ 7_	5.7	43	200
	V	5	В	-180	145	48	550

Project Engineer Review / 10/5/93
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/27/93

	Date: _//2 // 43								
Time	Initials of Person	Field	Bus	Primary Si	ide	Secondary Side			
	Recording Data			Voltage, V	Current, amps	Voltage, kv	Current, ma		
1300	line	1	A-B	4	tagged	out-	>		
		2	Α	200	56	46	120		
		2	В	150	70	43	220		
	-	3	Α	-40	90	48	273		
		3	В	260	110	40	300		
		4	A	ow -					
		4	В	of DI-			>		
		5	A	255	13.5	43	500		
	V	5	В	280	145	40	550		
1500	me	1	A-B	*	tagged	- ont-	>		
		2	Α	160	40	44	100		
		2	В	260	70	0 15	220		
		3	Α	270	90	403	273		
		3	В	- 50	105	44	300		
		4	Α	off.					
		4	В	2/2-			->		
		5	Α	230	سدا	+ 0,	-00		
	W	5	В	<i>'\U</i>	145	نان	550		

Project Engineer Review RS 10/5/93
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

		·			Da	atc:7/_	7/9:
Time	Initials of Person	Field	Bus	Primary S	ide	Secondary	Side
	Recording Data		·	Voltage, V	Current, amps	Voltage, kv	Current, ma
1700	lue	1	A-B	-	Jugget.	atit	>
		_ 2	Α	220	کے کھے	45	120
		2	В	240	70	~ ² ,	22.0
		3	Α	260	90	120	175
	·	3	В		10-	-3	200
		4	Α	04.A-			
		4	В	سسکن د			
		5	Α	272 272	آدا	بر - بر	500
		5	В	2 90	143	47	ڕڒڐ
1900	<u>-</u>	1	A-B	← た	unged a	オー	
		2	Α	160	40	4 L	100
		2	В	250	70	46	210
		3	Α	260	90	48	275
		3	В	260	105	÷ 9	300
		4	Α	Nin-			
		4	В	-12/2			
		5	Α	-80	135	44	Ξυο
		5	В	220	14-	42	320

Project Engineer Review Fig. 19/5/93
Initials/Date

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM BOILER PROCESS DATA

(Record data hourly)

7/28/93 Date: Furnace Throttle Drum Initials of Load, Steam temp., F Time 64 65 68 MW Outlet Steam Steam person Recording Oxygen, Pres. Flow. SH RH percent Data psig klb/hr Outlet Outlet 116 1469 1º Em 1,82 980 1534 1002 **ROD** 853 117.2 (000 1535 1.70 983 6500 ROD 116.5 A DETER WAS 1.72 975 868 0800 1000 1535 879 1015 1600 115.8 1.83 189 1534 CALIBRATE U 1000 24 Ear. PIN ROD 985 1.79 881 116.5 dool 1535 100 **RDD** 897 112.7 1.82 989 **1534** 1000 1200 ROD 1.66 994 117.3 1001 1534 282 1300 986 1535 1.34 £88 AGB1000 117.6 1400 KCD) 889 117 -1.52 884 1500 1000 B32 1617 SHEAR 994 885 117.9 WPR. 999 1.51 1533 1400 PIN 2B-012 995 1621 1700 WPR 118.1 1.68 1535 886 1000

Project Engineer Review FB 10/5/43
Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA (Record data hourly)

CA3A 3H 3Date: 7(28/93

	-	6A 3A	3H		
Time	Initials of Person Recording Data	Total Coal Flow, klb/hr	Stack SO2, ppm	Stack NOx, ppm	Stack Opacity, percent
0700	FEM	91.77	2.26	1, 35	3.1
05/50	RDE	90.9	2.75	1,38	3.10
09 <i>0</i> 0	RDD	91.5	2,43	1.3 4	3.10
1015	ROD	93.9	2.61	1,32	3,10
1100	RDD	92.4	2.54	1,29	3,09
1900	RDD	93.9	2,49	1.25	3.16
1300	SEC	94.8	2.55	1,31	2.66
1400	800	93.6	2,74	1.31	2.66
1500	400	92.0	2.56	1,37	2.66
1600	WPR	95.8	2.73	1.35	2.66
1700	MPR	95.9	2.72	1.33	3.0
	<u> </u>				

Project Engineer Review RES 10/5/43
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP LATA (Record data every two hours)

Date: 7/28/93

Time	Initials of Person	Field	Bus	Primary Si		Secondary	
	Recording Data	·		Voltage, V	Current, amps	Voltage, kv	Current, ma
0900	John	1	A-B	to	ged on	<u> </u>	->
		2	A	120	, 2 o	44	100
		2	В	260	70	44	2:0
		3	Α	260	95	0	2.77
		3	В	760	105	49	200
		4	Α	4	off -		>
		4	В	-	off -		-
		5	Α	275	135	49	200
	V	5	В	280	145	43	<i>550</i>
,	ins	1	A-B	Tou	e out		
		2	A	170	50	42	120
		2	В	250	70	49	220
		3	Α	2402	45	<i>y</i> a	-75
	1	3	В	250)	43	370
• -	i	4	Α	MA			
		4	В	01/			
	1/	5	Α	. <u>5</u> 0	٠ ٠	10	500
7		5	В	280	145	48	2.50

Project Engineer Review RB 10/5/93
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/20/93 Initials of Field Bus Primary Side Secondary Side Time Person Recording Voltage, Current, Voltage, Current, Data amps kv ma theores dut . 1300 1. 16 1 A-B 5.0 مد شا 210 2 Α ر ـ ـ 70 2 245 43 В ユーン (10 90 260 3 A 260 --- (a) 3 В 10-4 A 4 В 280 40 500 5 A 130 40 250 ۲ 5 В 14-Our 1700 1 A-B tuaz: 1 て、 200 45 100 2 Α 0) 140 48 2 70 В 220 263 90 3 ± 0 A 265 105 3 В $\mathcal{C}_{\mathcal{C}}$ > 7.7 4 Α 4 В - 40 48 5 135 こりつ Α 5 280 133 43 В

Project Engineer Review Rb 10/5/93
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/18/93 **Primary Side** Field Bus Secondary Side Initials of Time Person Recording Voltage, Voltage, Current, Current, Data amps kv ma - Janesel A-B 1 1700 215 40 2 50 A LU 250 48 2 B 70 110 270 90 ļ 3 50 A 275 265 105 48 3 В 300 4 Α В 4 250 49 5 135 Α 200 280 5 В 145 1 A-B 2 Α 2 В 3 Α 3 В Α 4 В 5 A 5 В

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM BOILER PROCESS DATA

(Record data hourly)

Date: 7/29/93

					Date:		
Time	Initials of person	Load, MW	Furnace Outlet	Steam tem	ip., F CA 68	Drum Steam	Throttle Steam
	Recording Data		Oxygen, percent	SH Outlet	RH Outlet	Pres., psig	Flow, klb/hr
3700	7 Em	116	1,97	100)	983	1531.	14:8
: 200	4.7.	117	1.82	1000	990	632	863.88
0900	7-F.J.	117	1.95	999	793	1534	867.83
1000	G.J.J.	117	1.96	1001	991	1533	862-36
1100	S.P.J.	117	1,46	1000	986	1532	865.20
1200	9.P.J.	117	1.86	1000	9.89	1533	863.80
1300	G.F.J.	116	1.42	1001	986	1535	868.06
1400	G-P.V.	116	1.81	1000	988	1534	865.53
1500	9. P.J.	116	1.67	1000	986	1534	867.60
1600	SHUP	116,7	1.65	1000	988	1525	866.67
1700							
1800							
		i		<u> </u>			
	<u></u>		 	<u> </u>			

RVB 145/93

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM
EMISSIONS DATA
(Record data hourly)

		6A 3F	3H	3HDate:_	7/29/9
Time	Initials of Person Recording Data	Total Coal Flow, klb/hr	Stack SO2, ppm	Stack NOx, ppm	Stack Opacity, percent
0700	12m	92.40	2.58	1.29	3,09
0800	4. P.J.	94.8	2.48	1.33	3.10
0900	G. 47	93.8	2.41	1.31	3.1
1000	J.P.J.	96.6	2,44	1.32	3.1
1100		95.0	2.2	1.54	/ وتن
1200	g pg	95.3	2.33	1.29	3.1
1300	S.P.T.	93.3	2.60	1.31	3./
1400	G.F.J.	93.9	2.71	1.34	3./
1500	J.P.T.	93.4	2.57	1.29	3.1
1600	The	95.6	2,58	1.31	٦.٩
1700					
1800			<u> </u>		
		<u> </u>			
	<u> </u>				
			• • • • • • • • • • • • • • • • • • •		

Project Engineer Review Bs 10/5/93
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/29/93 **Primary Side** Initials of Bus Field Secondary Side Time Person Recording Voltage, Voltage, Current, Current. Data amps kv ma nt سهندا A-B tugged 1 0900 44 2 A 205 50 120 175 70 46 270 2 В 90 265 てつ 3 A) フェ 105 300 3 · В **465** 4 A off 4 В 280 135 A 40 ٠ 5 **500** (j 280 145 5 В 46 ここの A-B 1 et an 1106 120 2 210 50 46 A 220 2 440 В 240 70 260 44 3 90 A 275 265 3 105 300 В • 4 B 5,80 500 135 5 A 44 49 146 200 В 220

Project Engineer Review RS 10/5/93
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: _7/29/93 Primary Side Secondary Side Initials of Field Bus Time Person Recording Voltage, Current, Voltage, Current, Data amps kv ma aut -·300 tured 1 A-B 47 مار 50 220 A 2 45 210 140 70 2 В 90 **-** 0 275 3 Α 105 В 1 4 2. **201** 3 · 4 A 4 В -80 133 49 A . 5 ラクレ 290 145 48 550 5 tageed A-B 1500 1 LLO 44 50 2 Α 120 133 46 70 2 В 220 90 3 A 260 30 o 2 70 10-3 В 4 A B 4 23,0 135 49 200 5 A 40, 5 1 00 145 В 14/

Project Engineer Review F33 10/5/93
Initials/Date

TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM BOILER PROCESS DATA

(Record data hourly)

				1	Date: <u>67</u>	-30-9	5 .
Time	Initials of person Recording Data	Load, MW	Furnace Outlet Oxygen, percent	Steam tem	P., F CA 6E RH Outlet	Drum Steam Pres., psig	Throttle Steam Flow, klb/hr
0700	18m	116	143	100 1	973	1535	سعبد سند
0800	J.P.T	116	1.95	999	980	1534	865.72
£100	G.F.J.	116	2.16	1000	986	1533	86470
1000	21.7.	117	2.14	1000	992	1535	864.22
1100	I.P.J.	117	1.82	1000	993	1533	862.41
,200	SAIT	117	2.15	999	993	1534	864.20
300	J-PS.	117	1.98	999	991	1531	85861
1460	GPJ.	117	2.07	1990	995	1534	862.66
1500	C. P. T.	116	2.17	999	989	1529	862.83
1600						<u></u>	
1700						ļ	<u> </u>
1800					ļ		ļ
		<u> </u>	<u> </u>				
			ļ			ļ	<u> </u>
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		ļ				<u> </u>	
<u> </u>				ļ		<u> </u>	<u> </u>
<u> </u>		 				 	ļ
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Project Engineer Review Russell Initials/Date

TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA (Record data hourly)

	_ 6A 3A		3H 3HDate: 07-30-93				
Time	Initials of Person Recording Data	Total Coal Flow, klb/hr	Stack SO2, ppm	Stack NOx, ppm	Stack Opacity, percent		
2700	7Em	90,10.	2.65	1, 3 3	3,/0		
08:00	9.7.7.	92.1	2.75	1.32	3.1		
0900	4.70.	94.2	2.63	1-24	3.1		
1000	9. P.V.	94.4	2.64	1.28	3.1		
1100	47.7.	74.8	2.64	1.31	3./		
1200	G.P.J.	94.6	2.65	1.36	3./		
1300	J.P.J.	94.3	2.82	1.38	3-1		
1400	Lifes.	95.2	2.59	1.36	3./		
1500	F.J.	93.4	2.61	1.40	3./		
1600							
1700							
1800							
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				<u> </u>	<u> </u>		

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Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/30/93 Initials of Bus Primary Side Field Secondary Side Time Person Recording Voltage, Current, Voltage, Current, Data amps kv ma Jane-A-B 1 0900 48 42 2 A 130 700 45 220 2 B 70 230 80 てっ 3 275 A 260 48 260 IOC 300 3 В 4 A 4 В 49 . 5 500 A 135 780 145 48 550 5 B tagend 4-100 A-B 130 2 48 A 200_ 44 235 770 2 В 70 46 260 90 3 275 A 49 160 105 48 3 B 300

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TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/30/73 Bus **Primary Side** Secondary Side Field Time Initials of Person Recording Voltage, Current, Current Voltage, Data amps kv ma 1300 1 A-B 1 30 50 10 2 A 230 44 220 2 В 260 10 49 3 275 A 460 300 3 · В 48 107 4 A 4 В Uld-49 500 780 135 . 5 A 180 43 5 **350** В aut 1500 1 A-B 44 130 50 2 235 70 46 220 2 В 40 275 3 260 48 300 260 107 4 A 4 B off 500 280 35 5 Α 520 5 290 В

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Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

	-	* ***	_		D:	ate: <u>7/3</u>	30/75
Time	Initials of Person	Field	Field Bus Primary Side Secondary S		Side		
	Recording Data			Voltage, V	Current, amps	Voltage, kv	Current, ma
טטדו	-	1	A-B	-	tagger	air-	>
	·	2	· A	<u> </u>			
		2	В				
		3	Α		_		
		3	В			•	
		4	A	earl -			,
		4	В	= oft -			\$
		. 5	A			-	
		5	В				
		1	A-B				
		2	A	******			
		2	В				
		3	A				
		3	В				
		4	Α				
		4	В	1			
		5	Α				
		5	В				

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TABLE 5-26. PROCESS DATA LOG NO. 1: POWER PLANT CONTROL ROOM BOILER PROCESS DATA

(Record data hourly)

Date: 7/31/93

Time	Initials of person	Load, MW	Furnace Outlet	Steam tem	Steam temp., F		Throttle Steam
	Recording Data		Oxygen, percent	SH Outlet	RH Outlet	Pres., psig	Flow, klb/hr
0700	18m	115	1,58	1003	966	1533	.470
0800	WPR	116.7	1.97	1000	977	1533	&√7.5
0900	WPR	717.6	1.87	1000	983	1536	828,48
1000	WPR	117.2	1.77	1000	985	1535	868.48
1100	WPR	117.0	1,76	999	986	1533	866.34
1200	MPR	117.3	2.06	1000	989	1529	871.03
1300	WPR	118.3	2.01	1000	994	1535	87 <i>5</i> .31
1400	WPR	116.7	1.87	1000	989	1526	868.61
1500	WPR	118.1	1.97	1000	993	1533	873.75
1600	HP	117.5	1.92	1001	99 L	11,92	868.64
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TABLE 5-27. PROCESS DATA LOG NO. 2: POWER PLANT CONTROL ROOM EMISSIONS DATA

(Record data hourly)

		(Record	- (/		
		6A 3H	3.H	3 _M Date:_	7/3//93
Time	Initials of Person Recording Data	Total Coal Flow, klb/hr	Stack SO2, ppm	Stack NOx, ppm	Stack Opacity, percent
0700	78m	91.08	2.43	1,21	3,56
0500	WPR	94.70	2.30	1.27	3.10
0900	WPR	95.2	2.35	1,29	<i>3,55</i>
1000	WPR	95.5	2.39	1.31	3.09
1100	WPR	95.5	2.43	1,34	3.10
1200	WPR	97.1	2.43	1.41	3.10
1300	22	97.2	2.41	1.46	3.09
1400	WPR	97.6	2.35	1.37	3.10
1500	WPR	98.1	2.34	1.38	3.09
1600	HP	97.6	2.00	1.41	J.10
		<u> </u>			
		<u> </u>			
		<u> </u>	<u> </u>		
				<u> </u>	
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TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

93/93 Date: 7 Primary Side Initials of Field Bus Secondary Side Time Person Recording Voltage, Voltage, Current, Current Data kv amps ma مہار سلسنه - 加 1 A-B 0400 160 50 42 2 100 A 235 220 2 46 В 90 265 30 275 3 A 250 48 300 110 3 В 4 Α 4 В 100 280 . 5 135 49 500 Α 49 145 220 5 550 tagget out-1100 1 A-B 45 200 120 2 50 A 70 240 2 В 46 220 275 J 0 3 265 90 A 765 105 300 3 400 В c-f-f- -4 A 4 B

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500

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7,80

2092

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TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/3//93 Secondary Side Bus Primary Side Field Initials of Time Person Recording Current, Voltage, Voltage, Current Data amps kv ma たし o treda A-B 1300 1 120 46 2 A 50 220 48 720 2 В フロ 240 90 52 270 275 3 A В 300 3 -105 4 A 4 B 44 500 . 5 A 49 550 145 5 В 1 A-B rigged av 1100 46 120 2 5 O A 7 10 40 220 2 В 70 140 90 3 A 270 7.75 3 В 265 10 t 300 4 4 ←,レィ*Ϳ*ͺ 135 5 280 500 49 A 280 5 145 48 SIU

Project Engineer Review RB 10/5/93
Initials/Date

TABLE 5-28. PROCESS DATA LOG NO. 3: ESP DATA (Record data every two hours)

Date: 7/31/43 Field Bus Primary Side Secondary Side Time Initials of Person Recording Voltage, Voltage, Current, Current, Data amps kv ma en tog ant A-B 1600 1 50 2 Α 2 В 220 70 90 3 A 275 50 3 · В 100 270 300 4 A 4 В 500 5 A 180 145 49 550 В A-B 1 2 A 2 В 3 A 3 В 4 A 4 В 5 A 5 В

Project Engineer Review PS 19/5/93
Initials/Date

APPENDIX B

AUDITING

AUDITING

B-1. Introduction

No audits were conducted at Niles Station during the period of sampling at Boiler No. 2. However, during the previous week (i.e., the week of July 18-24) Battelle and Chester staff conducted six days of solid, liquid, and flue gas sampling at the SNOX process, an Innovative Clean Coal Technology Demonstration Project operating at Boiler No. 2. During that time period, Research Triangle Institute (RTI) conducted technical and performance audits of the field effort. Those audits took place on July 20 and 21, 1993. Because the Boiler No. 2 field effort described in this report followed immediately after that at the SNOX process, the RTI audits are considered to apply to the Boiler No. 2 study as well.

The RTI activities included technical audits, performance audits, and CEM calibrations. Those separate activities are discussed in Sections B-2 through B-4, respectively. The RTI Field Sampling Audit Report for Niles Station is included at the end of this Appendix.

B-2. Technical Audits

The following are responses to specific comments made by RTI; these are organized under the same headings and in the same order as the original comments in the enclosed RTI report.

Findings

(1) There is no intent of assigning all of the probe rinse particulate to any one particle size fraction. This material is considered as a separate component, for example in discussion of particle size distributions in Section 7.3. Given the constraints of flue gas sampling at the ESP inlet, there was no alternative to use of the extractive sampling mode.

- (2) The glass cyclones were designed to provide the desired particle size cuts, and to be accommodated within a Method 5 heated box along with the particulate filter. Insufficient time was available before the field study to conduct verification tests, but the flow rates used in the field were appropriate for achieving the desired 10 μm and 5 μm size cuts.
- (3) This comment does not apply to Boiler No. 2 sampling.
- (4) The Fyrite solutions used by Chester for O₂ measurements at Locations 5a and 5b at Boiler No. 2 were replaced regularly, following this comment from RTI auditing previous to the Boiler No. 2 measurements.
- (5) No response needed.
- (6) Blank samples were taken of all reagents made up with the deionized water, for blank subtraction.
- (7) The impact on data should be minimal, since gas flow/reagent volume ratios were similar with the two sizes of glassware.
- (8) The potential for some effect from SO₂ in the flue gas is real, however, it is not clear how "bleaching" of DNPH solution by SO₂ could be greater in the second impinger than in the first. The procedure used was discussed with knowledgeable staff at U.S. EPA prior to the study, and the aldehyde results appear reasonable (see Section 5.7).
- (9) This comment refers to the baghouse at the SNOX process, but the same tool was used in collection of ESP ash at Boiler No. 2. The impact on ash composition data is almost certainly negligible, given the ample quantities of ash collected, and the small amount of damage to the sampling device.
- (10) This comment is not pertinent to sampling at Boiler No. 2.

Observations

- (1) No comment needed.
- (2) No comment needed.
- (3) This comment refers to an issue that field staff were not qualified to address. To the extent possible, review of analytical data has been conducted in compiling data for this report, and in preparing study data for the PISCES data base format.

Recommendations

- (1) This recommendation appears to contradict the comments made by RTI under Findings, Item 5. No critical weighings were conducted in the field, so NIST-traceable weigh checks are unnecessary.
- (2) Reagent blanks were analyzed for all sampling methods, and the data shown in this report have been properly corrected. The water itself was not analyzed.
- (3) The scope of this study does not include such an investigation. As noted above, guidance from U.S. EPA indicates the method should not be invalidated by elevated SO₂ levels.
- (4) The use of such a model would be very prone to error, given the frequently changing configuration of the probe and flexible line combination. No useful information would be obtained from such an effort.
- (5) Validation testing such as that suggested is beyond the scope of the present study, though it may be of value in future work. Given that the cyclones were used at only one location having a very high particulate loading, such an effort would have minimal effect on the results of this study.
- (6) During sampling at Boiler No. 2, the Fyrite sample solutions were changed regularly to avoid use of aged solutions.

B-3. Performance Evaluation Audits

As indicated in the enclosed RTI Field Sampling Audit Report, RTI performed Performance Evaluation Audits (PEA) by spiking sampling materials with target analytes. Tables B-1, B-2, B-3, and B-4 show the results of the analyses of the spiked samples for metals, PAH, VOST, and aldehydes, respectively. For each spiked sample, the mass of analyte found by Battelle, the mass of analyte spiked into the sample as reported by RTI, and the percent recovery of the spiked analyte are shown. The significance of these results is discussed according to analyte class in the following paragraphs.

Metals

As shown in Table B-1, six of the recoveries for the PEA samples are outside of the range of 70 to 130 percent. Battelle's accuracy requirement for metals was 80 to 120 percent recovery for certified standard materials. Since the PEA samples are not certified standards, and since analyte losses may have occurred during spiking, a wider range for these analyses is considered acceptable.

For the filter samples, mercury and selenium showed lower recoveries than the other three analytes (excluding cadmium in N-18-MUM-721). This result could be due to potential losses of these compounds during the spiking process or during sample handling, preparation, and analysis.

The 55 percent recovery for cadmium in N-18-MUM-721 filter is considered an outlier since cadmium recoveries for all other samples are acceptable.

The 44 percent recovery for selenium in N-18-MUM-721 (solution) is attributed to the low spike level and the anticipated lower analytical accuracy near the detection limit of a method. The detection limit for selenium in prepared H₂O₂ impinger solution was 0.01 mg/L; the detected level in N-18-MUM-721 was 0.07 mg/L. This low selenium recovery is not expected to occur in actual samples because selenium levels in most samples were found at much higher concentrations.

PAH

As shown in Table B-2, recoveries for almost all of the PAH in the PEA samples were between 50 to 150 percent. This accuracy limit was established on this project for recovery of deuterated PAH spiked into samples prior to extraction and is reasonable to use as a limit for the PEA samples.

The low recovery of the volatile PAH naphthalene from spiked filters results principally because this compound was spiked onto blank filters rather than onto particulate matter on filters. Volatile PAH are more stable on particulate matter than on blank filters. Much of the spiked naphthalene was likely lost from the blank filters during sample handling and transporting. Acenaphthylene and acenaphthene are similarly volatile and also showed

slightly lower recoveries on the filter PEA samples in comparison to the other PAH. An alternative approach to spiking would be to spike collected filter samples with deuterated PAH. The low recovery for naphthalene on the filter PEA samples is not expected to affect sample results since this volatile PAH would be bound on particulate in actual filter samples and less susceptible to the losses described here.

The recovery (162 percent) for dibenzo(a,h)anthracene from the N-19 filters was higher than 150 percent for one of the four PEA samples. Since all the recoveries for other PAH in this sample were in the acceptable range, this high recovery is probably due to contamination in the field spiking process, or in sample handling, or in the laboratory. However, this high recovery should not affect sample results because dibenzo(a,h)anthracene was not detected in the field blanks and laboratory method blanks.

VOST

For the majority of the VOST compounds (Table B-3), recoveries of the spiked compounds into the PEA samples were within 26 to 160 percent. This accuracy limit was established for recovery of surrogate spikes from VOST samples and is reasonable to use as a limit for PEA samples.

The recoveries for bromomethane were lower than 26 percent in two of the three PEA samples. These low recoveries are attributed to losses due to volatility. It cannot be determined whether these losses may have occurred during the spiking process or during analysis. If losses occurred during analysis, then sample results may have been affected in a similar manner.

The recoveries for trichloroethene were higher than 160 percent for two of the three PEA samples. This high recovery is probably not due to contamination in the field or laboratory since trichloroethene was not detected in actual samples (detection limit of 0.025 μg). It may be due to an error in the amount spiked or inaccurate quantification (i.e., calibration) of trichloroethene in the analysis. However, these two causes would not prevent the detection of trichloroethene in the actual samples; and since trichloroethene was not detected, the high trichloroethene recoveries do not affect sample results.

Vinyl chloride was not detected (ND) in the PEA samples at a detection limit of $0.025 \mu g$. Since the spike levels are well above the detection limit, these results suggest that, like bromomethane, losses of vinyl chloride may have occurred during the spiking process or during analysis.

Methylene chloride results are not reported (NR) for the PEA samples because spurious contamination in VOST blank samples made data for all samples suspect.

Battelle did not analyze 1,3-butadiene, trichlorofluoromethane, or 1,2-dibromomethane as a part of this project so results are not provided for these compounds in the PEA samples.

Aldehydes

The recoveries for formaldehyde spiked into the PEA samples were between 50 to 150 percent as listed in Table B-4. This limit was established on this project for recovery of aldehydes and is reasonable to use as a limit for the PEA samples. These acceptable recoveries suggest that recovery of target aldehydes from actual samples was effective.

B-4. CEM and Sensor Audits

As described in the enclosed RTI report, RTI audited Battelle's paramagnetic O₂ analyzers, Chester Environmental's Fyrite O₂ analyzers, dry gas meters from both groups, and SO₂ and NO_x CEM instruments operated by ABB at the SNOX facility. All but the last are pertinent to the Boiler No. 2 sampling effort. Results of these audits are tabulated in the enclosed RTI report. Battelle's dry gas meter results, noted in the RTI report, were provided to RTI, and to the best of our knowledge agreed within a few percent with the RTI audit.

B-5. Battelle Project Audits

A copy of the findings of the audits conducted by Battelle's Quality Assurance Project Officer is provided as the last part of this appendix.

B-6. Results from Coal Analysis Round Robin

Results from the coal analysis round robin coordinated by Consol, Inc. (Consol) for DOE/PETC are presented in Tables B-5 and B-6 for Samples F and O, respectively, which are the duplicate samples generated from Niles coal provided by Battelle to Consol.

A comparison of the average round robin results for Niles coal from all five laboratories participating in the study, with the results provided in Table 5-6 of Section 5 of this report for Niles boiler feed coal, is provided in Table B-7. In general, the relative percent difference between the average results for detected elements in the boiler feed coal presented in Table 5-6 and the average result obtained for Niles coal (designated Samples F and O) by the five laboratories participating in the round robin study was less than 30 percent. (The relative percent difference values were calculated as the difference between the two dry averages, divided by the mean of the two averages.)

The shaded results in Table B-7 indicate cases where the average round robin result was used in mass balance calculations instead of the result provided in Table 5-6 of this report. For three of the elements, cadmium, molybdenum, and selenium, the round robin result was used to replace a nondetected value reported in Table 5-6 to provide better accuracy.

Antimony and nickel were the only two detected elements with relative percent differences above 30 percent, at 56 percent and 38 percent, respectively. The average antimony result from the round robin result (2.1 μ g/g, dry, versus 1.1 μ g/g, as received in Table 5-6) was therefore used in the mass balance calculation. The average nickel result from the round robin study (28.2 μ g/g, dry, versus 18 μ g/g, as received, in Table 5-6) was not used in the mass balance calculations because the percent relative standard deviation associated with nickel in the round robin study was relatively high (average of 33.1 percent), as was the range (76 percent) in comparison to the other elements. This suggested that the round robin result was not more accurate than the result presented in Table 5-6.

TABLE B-1. RESULTS FOR RTI PERFORMANCE EVALUATION AUDITS - METALS

	_	N-18-MUM-721	M-721		N-19-MUM-721	M-721	_	N-18-MUM-721	M-721	~	N-19-MUM-721	N-721	_	N-18-MUM-721	M-721		N-19-MUM-721	M-721
		Filter			Filter			H2O2 Solution	lution		H2O2 Solution	lution	Ž	MNO4 Solution	olution	¥	KMNO4 Solution	olution
-	Found Spiked	Spiked	Percent	Found Spiked		Percent	Found S	Spiked	Percent	Found Spiked	Spiked	Percent	Found Spiked	Spiked	Percent	Found	Found Spiked	Percent
,	(gn)	(Bn)	Recovery	(Gn)	(Bn)	Recovery	(Bn)	(Bn)	Recovery	(Bn)	(Bn)	Recovery	(Bn)	(Bn)	Recovery	(Bn)	(Bn)	Recovery
Arsenic	26.8	ဓ္က	89	28.3	30	94	23.1	30	77	23.1	30	77	SN	l	Š	SN	SN	S
Cadmium		20	55	26.5	30	88	14.4	20	72	30.6	40	77	SN		Š	SS	SN	ပ္ရ
Lead	13.1	15	87	27.3	8	91	11.88	15	79	7.5	9	75	S		S	SS	SS	S
Mercury	13.4	ဓ္က	45 *	4	30	47 •	25.2	8	84	SS	SN	S	24.8	29	124	13.12	9	131
Selenium	7.8	9	78	14.2	8	47 •	4.38	9	44 •	35.6	20	71	SZ	SZ	2	SS	SZ	Š

*Recovery outside of 70 to 130 percent. NS = Not spiked; NC = Not calculated.

TABLE B-2. RESULTS FOR RTI PERFORMANCE EVALUATION AUDITS - PAH

	N-18	N-18-MM5-720 (XAD)	(XAD)	N-19.	N-19-MM5-720 (XAD)	(DVX	N-18	N-18-MM5-720 (Filter)	Fifter)	N-19	N-19-MM5-720 (Filter	Filter)
	Found	Spiked	Percent	Found	Spiked	Percent	Found	Spiked	Percent	Found	Spiked	Percent
Compound	(ng)	(Bn)	Recovery	(Bn)	(GD)	Recovery	(BD)	(bn)	Recovery	(fin)	(Bn)	Recovery
100000		•	0		ć	ř	_					
Naphmaiene	0.00	0.0	80	20.00	70.U	C	0.288	D.O.	છ	0.671		•
Acenaphthylene	18.40	20.0	92	25.90	40.0	65	7.05	10.0	7.1	19.00		63
Acenaphthene	8 60	10.0	98	14.20	20.0	7	3.43	5.0	69	9.84	15.0	99
Fluorene	2.08	2.0	104	3.66	4.0	92	1.01	1.0	101	2.85		95
Phenanthrene	0.958	0.1	96	1.72	2.0	98	0.540	0.5	108	1.45	5.	97
Anthracene	0.942	1.0	7 6	1.75	2.0	88	0.467	0.5	93	1.40		60
Fluoranthene	194	2.0	97	3.47	6. 0	87	1.01	1.0	101	2.93	•	80
Pyrene	956.0	0.1	96	1.72	2.0	86	0.482	0.5	96	1.40		66
Benz(a)anthracene	1.05	0.1	105	2.08	2.0	104	0.575	0.5	115	2.05		137
Chrysene	1.09	6 .	109	1.80	2.0	96	0.534	0.5	107	1.83	5:	125
Benzo(b+k)fluoranthene	3,95	3.0	132	8.40	0.9	140	1.88	1.5	125	4.37	4.5	97
Benzo(a)pyrene	1.16	0.1	116	2.48	2.0	124	0.486	0.5	97	1.64		109
Indeno(1,2,3-c,d)pyrene	1.03	0.1	103	2.05	2.0	103	0.45	0.5	06	1.83	_	122
Dibenzo(a,h)anthracene	2.57	2.0	129	5.79	0.⁴	145	1.15	1.0	115	4.86	3.0	162
Benzo(g,h,i)perylene	1.94	2.0	97	4.23	0.4	106	0.93	1.0	93	3.65	3.0	122

*Recovery outside of 50 to 150 percent.

TABLE B-3. RESULTS FOR RTI PERFORMANCE EVALUATION AUDITS - VOST

	Z	N-20-VOS-721-4	1-4	Ż	N-20-VOS-721-5	1-5	N.	N-20-VOS-721-6	11-6
-	Found	Spiked	Percent	Found	Spiked	Percent	Found	Spiked	Percent
Compound	(Bn)	(Gn)	Recovery	(60)	(Bn)	Recovery	(Bn)	(Bn)	Recovery
Bromomethane	0.078	0.249		0.061	0 248	. 52	0 041	0.252	<u>*</u>
Chloroform	0.143	0.174	82	0.160	0.174	92	0.152	0.176	2 g
1,2-Dichloroethane	0.151	0.147		0.097	0.147	99	0.102	0.149	889
1,1,1-Trichloroethane	0.339	0.296		0.448	0.295	152	0.410	0.299	137
Carbon tetrachloride	0.221	0.245		0.275	0.244	113	0.273	0.247	111
1,2-Dichloropropane	0.566	0.382		0.470	0.380	124	0.458	0.385	119
Trichloroethene	0.258	0.206		0.384	0.205	187 *	0.363	0.208	175 *
Benzene	0.177	0.127		0.154	0.126	122	0.150	0.128	117
Tetrachioroethene	0.361	0.281	•	0.405	0.280	145	0.382	0.284	135
Toluene	0.271	0.305		0.302	0.300	101	0.293	0.304	96
Chlorobenzene	0.427	0.353		0.444	0.351	126	0.430	0.356	121
Ethylbenzene	0.319	0.306	•	0.320	0.305	105	0.285	0.309	92
Xylenes (Total)	0.138	0.317		0.123	0.316	39	0.088	0.320	27
Vinyl chloride	2	0.0798		2	0.0794	2	Q.	0.0805	S
Methylene chloride	œ Z	0.225		¥	0.224	ပ္	Z,	0.227	S
1,3-Butadiene	¥ Z	0.052		¥ Z	0.0514	Ş	¥	0.0520	Ş
Trichlorofluoromethane	¥ X	0.432	Š	¥ Z	0.430	S	₹ Z	0.436	S
1,2-Dibromomethane	NA NA	0.597		NA	0.595	NC	ž	0.603	S

*Recovery outside of 26 to 160 percent. ND = Not reported; NA = Not analyzed. ND = Not detected (detection limit of 0.025 μ g); NR = Not reported; NA = Not analyzed.

TABLE B-4. RESULTS FOR RTI PERFORMANCE EVALUATION AUDITS - ALDEHYDE

r	
1 (Imp. 3) Percent Recovery	120
N-ALD-DUP-721 (Imp. 3) ound Spiked Percent (ug) (ug) Recoven	3.2
	3.85
(Imp. 2) Percent Recovery	117
N-ALD-DUP-721 (Imp. 2) ound Spiked Percent (ug) Recovery	2
N-ALD Found (ug)	2.347
рилод	Formaldehyde
S S	Fom

TABLE B-5. INDIVIDUAL LABORATORY ANALYSES OF ROUND ROBIN SAMPLE F

PPM DRY WHOLE COAL BASIS

7.0	IHACE ELEMENTS	RUN 1	AB I RUN 2	BUN 1	LAB II RUN 2	RUN 1	LAB III 1 RUN 2	BUN 1	B IV	₹	LAB V
8-424 90.43 95.51 95.07 17 17 24 ND 28.7 2.53 55.36 55.51 96.4 98.1 93.0 55.6 66 65 66 55.30 2.54 20.1 2.1 11.2 2.1 2.1				. :					5		NOU P
85.29 96.74 64.7 69.46 773 776 66 6 6 6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9		4.82	50.43	35.51	35.07	17	17	24	2	28.7	28.1
S5.36 25.51 86.4 98.1 83 65.6 83 83 83 83 83 83 83 8		89.23	96.74	64.7	63,46	73	92	89	65	64.9	53.4
25.67 2.78 2.14 2.18 19 2 2 2.3 2.4 2.75 22.56 22.64 25.35 28.97 19.7 21.7 20 2.1 2.25 22.56 22.64 25.35 28.97 19.7 21.7 20 2.1 2.25 22.56 22.64 25.35 28.97 19.7 21.7 20 2.1 2.2 2.3 2.4 2.75 21.0 2.1 0.2 0.0 0.0 0.1 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2		55.38	53.51	86.4	98.1	83	85.6	83	6	2	A7.3
22.64 25.95 22.64 4.03 4.03 6.06 6.09 21 6.09		2.67	2.78	2.14	2.18	6:	2	2.3	2.4	275	2.40
22.56 22.64 25.35 28.97 19.7 21.7 20 21 11.2 20.5 11.5 11.5 20.5 11.5 11.5 11.5 11.5 11.5 11.5 11.5 1		0.07	60'0	0.1	0.12	<0.3	<0.3	<0.4	¥0>	2000	2
21.54 1132 5.9 5.8 6.23 6 8 7 4.56 21.54 21.61 17.35 17.07		22.56	22.64	25,35	28.97	19.7	21.7	8		1.0	5 2
2154 2161 17.35 17.07		9.74	11.32	5.9	5.88	6.23	'	ec	; ^	4 F. A.	7.7.6
Color		21.54	21.61	17.35	17.07	<37.8	<37.4	, S	- 5	000	9 0 0
0.21 0.27 0.239 0.251 0.24 0.26 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25		×100	× 100	90.46	92.55	6	100	S	Ş	1	2.3 8.8
2564 15.73 26.6 26.6 27 23.2 30 31 25.5 26.6 2.6 2.6 2.6 2.6 2.7 38 6.40 4.25 4.46 25.6 3.8 26.6 2.8 3.8 2.6 2.6 2.7 23.5 2.6 2.7 23.6 2.6 2.6 2.7 23.7 23.6 2.6 2.6 2.7 23.7 23.6 2.6 2.6 2.6 2.7 23.7 23.6 2.6 2.6 2.6 2.7 2.6 2.6 2.7 23.7 23.6 2.6 2.6 2.6 2.6 2.7 23.7 23.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2		0.21	0.27	0.238	0.251	0.24	0.26	0.25	0 25	888	23.5
7.38 6.48 4.25 4.46 3.65 3.8 <6 6 192 2.66.7 29.84 21.98 22.39 26.8 28.2 25 26 192 2.66.7 29.84 21.98 22.39 16.97 2.1 2 2 2 ND 1.13 2.26 3.27 3.29 2 2.25 197 2.1 2 2 ND 1.14 4.219 26.06 27.99 3.5 36.3 35 36 36.5 OGEN 66.75 66.24 71.23 71.11 71.34 13.21 13.27 13.39 OGEN 66.75 66.24 71.23 71.11 71.34 13.21 13.27 13.39 OGEN 66.75 66.24 71.23 71.11 71.34 71.36 70.41 70.23 69.99 OGEN 66.75 66.24 71.23 71.11 71.34 71.36 70.41 70.23 69.99 OGEN 7.39 1.36 1.45 1.45 1.39 1.39 1.39 1.39 1.39 1.39 1.39 1.39		25.64	15.73	26.6	26.6	27	23.2	90	5	25.5	26.0
2667 2984 21.96 22.39 26.6 28.2 25 26 23.5 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3 1.3		7.38	6.48	4.25	4.46	3.65	3.8	9	9	1 20	5.0.2 F. F. F.
7.28		26.67	29.84	21.98	22.39	26.8	28.2	25	80	20.00	2.00
1.95 2.86 2.2 2.25 1.97 2.1 2 2 ND 1.5 ND 1.		7.28	9 .0>	15.67	15,66	.15	5	\$	17	10.0	7
1.13 2.26 3.27 3.29 2 3 ND 1.5		1.95	2.88	2.2	2.25	1.97	2.1	2		Š	2
MATE & ULTIMATE 13.42	-	1.13	2.26	3.27	3.29	C)	8	i e	2		, 5 °
MATE & ULTIMATE ON 66.75 66.70 66.75 66.75 66.75 66.75 66.75 66.75 66.75 66.75 66.70 66.75 66		40	42.19	26.06	27.98	33.6	36.3	SS	98	35.5	38.1
MATE & ULTIMATE 13.42						1					
ON 66.75 66.24 71.23 71.14 13.4 13.4 13.27 13.39 19 19.29 ON 66.75 66.24 71.23 71.14 71.34 71.36 70.41 70.23 69.98 69.98 OGEN 5.3 5.28 4.76 4.77 4.94 4.09 4.09 70.41 70.23 69.98 6.29 13.9 13.9 13.5 1.28 0.05 0.165 0.14 0.119 0.122 ND ND ND 0.12 12.207 10953 12674 12645 12645 12665 12666 12623 1.1 2.207 10953 12674 12646 12645 12609 12665 12668 12623 1.1 2.30 2.36 2.39 2.35 ND 22.1 1.12 ND ND 46.1 2.31 2.462 2.319 2.337 2.2.98 2.3.97 2.2.55 ND 22.1 1.12 ND ND 1.14 1.16 1.07 1.85 1.91 1.44 1.36 ND ND 0.21 1.1 20.78 0.33 0.37 0.37 0.35 0.25 0.25 0.47 0.86 ND ND 1.7 0.33 0.37 0.37 0.35 0.35 ND ND ND 1.3 ND ND ND 1.30 ND ND	OXIMATE & ULTIMA	\TE				* DRY	BASIS				
OGEN 66.75 66.24 71.23 71.11 71.34 71.36 70.41 70.23 69.98 69.00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ı	13.42	13.42	13.42	13.45	13,44	13.4	13.21	13.27	13.39	19.97
OGEN 5.3 5.26 4.76 4.77 4.94 4.69 4.63 4.58 4.77 1.39 1.35 1.43 1.45 1.39 1.39 1.36 4.58 4.77 1.04 0.15 0.14 0.119 0.122 ND ND 0.12 1.207 1.0953 1.2674 1.2648 1.2645 1.2609 1.2665 1.2693 1.2653 1.207 1.0953 1.2674 1.2648 1.2645 1.2609 1.2663 1.2653 1.2653 1.207 1.0953 1.2674 1.2648 1.2645 1.2663 1.2653 1.2663 1.2653	RBON	66.75	66.24	71.23	71.11	71.34	71,38	70.41	70.23	8000	500
OGEN 1.39 1.35 1.43 1.45 1.39 1.39 1.35 1.28 OF 0.15 0.15 0.14 0.119 0.122 ND ND 0.12 IPINE 0.6 0.05 0.155 0.14 0.119 0.122 ND ND 0.12 IPINE 0.05 0.155 0.144 0.119 0.122 ND ND 0.12 IPINE 0.05 0.155 0.144 1.2645 1.2645 1.2665 1.2668 1.2623 1.26 ASH ELEMENTS 1.2207 10953 1.2645 1.2645 1.2645 1.2665 1.2666 1.2623 1.2623 ASH ELEMENTS 45.66 49.3 47.16 46.04 ND ND 44.91 ND 46.1 ASH ELEMENTS 45.66 23.19 23.37 22.98 23.97 22.55 ND 22.1 1.12 1.12 1.23 1.06 1.07 1.185 1.91	JROGEN	5.3	5.28	4.76	4.77	4.94	4.59	4.63	4.58	4 77	75 A
HINE 0.6 0.05 0.155 0.14 0.119 0.122 ND ND 0.12 1.207 10953 12674 12645 12645 12609 12665 12686 12623 1.207 10953 12674 12646 12645 12609 12665 12686 12623 1.207 10953 12674 12646 12645 12609 12665 12686 12623 1.207 123 1.20 ND ND 44.91 ND 46.1 1.20 1.12 1.12 ND 46.1 1.20 1.07 1.30 1.30 1.30 ND 1.7 1.30 1.30 ND 1.7 1.30 1.30 ND 1.7 0.43 0.33 0.87 0.87 0.86 ND 0.24 2.39 2.22 2.3 2.32 1.92 2.11 2.05 ND 0.45 0.48 0.46 0.46 0.89 0.89 ND ND 1.53 ND 1.53 ND 1.53 ND 1.53	HOGEN	1,39	1.35	1.43	1.43	1.45	1 39	1.39	1.35	#C +	• •
FRINE 0.6 0.05 0.155 0.14 0.119 0.122 ND ND 0.12 12207 10953 12674 12645 12645 12609 12665 12666 12623 11	FUR	3.1	2.96	2.9	2,95	3.1	6	2.98	000	25.5	25
12207 10953 12674 12645 12645 12665 12665 12623 11 RASH ELEMENTS 45.86 49.3 47.16 46.04 ND ND 44.91 ND 46.1 23.1 24.62 23.19 23.37 22.98 23.97 22.55 ND 22.1 1.12 1.23 1.06 1.07 1.3 1.12 1.12 ND 1 20.76 23.02 21.68 22.01 20.9 19.67 ND ND 21.4 1.16 1.07 1.85 1.91 1.44 1.36 ND ND 0.24 0.43 0.33 0.87 0.87 0.73 0.86 ND ND 0.24 2.39 2.22 2.3 2.32 1.92 2.11 2.05 ND 0.25 0.47 0.53 0.46 0.46 0.89 0.89 ND ND ND 1.53 ND 1.53	LORINE	0.6	0.05	0.155	0.14	0.119	0.122	2	S	0.0	<u> </u>
## DRY ASH 45.86 49.3 47.18 46.04 ND ND A4.91 ND 46.1 23.1 23.1 24.62 23.19 23.37 22.98 23.97 22.55 ND 22.1 1.12 1.12 ND 1.12 ND 1.12 ND 1.12 1.12 ND 1.13 1.12 1.12 ND 1.14 1.14 1.15 ND ND 1.7 0.43 0.53 0.57 0.57 0.57 0.73 0.86 ND ND 0.74 0.73 0.73 0.73 0.73 0.73 0.74 0.73 0.74 0.75	Q.	12207	10953	12674	12648	12645	12609	12665	12688	12623	12583
ASH ELEMENTS 45.86						₹	HOA .				
45.86 49.3 47.18 46.04 ND ND 44.91 ND 46.1 23.1 24.62 23.19 23.37 22.98 23.97 22.55 ND 22.1 1.12 1.23 1.06 1.07 1.3 1.12 1.12 ND 1 20.76 23.02 21.68 22.01 20.9 19.67 ND ND 21.4 1.18 1.07 1.85 1.91 1.44 1.36 ND ND 1.7 0.43 0.33 0.87 0.87 0.73 0.86 ND ND 0.24 0.22 0.21 0.3 0.35 0.25 0.38 ND 0.24 2.39 2.22 2.3 2.32 1.92 2.11 2.05 ND 2.2 0.47 0.53 0.48 0.46 0.89 ND ND 1.53 ND ND ND 1.53	JOR ASH ELEMEN	TS									
23.1 24.62 23.19 23.37 22.98 23.97 22.55 ND 22.1 1.12 1.23 1.06 1.07 1.3 1.12 1.12 ND 1 20.76 23.02 21.68 22.01 20.9 19.67 ND ND 21.4 1.18 1.07 1.85 1.91 1.44 1.36 ND ND 21.4 0.43 0.33 0.87 0.87 0.73 0.86 ND ND 0.86 0.22 0.21 0.3 0.3 0.25 0.25 0.36 ND 0.24 2.39 2.22 2.3 2.32 1.92 2.11 2.05 ND 2.2 0.47 0.53 0.48 0.46 0.89 ND ND 0.45 ND ND ND 1.53	~~	45.86	49.3	47.18	46.04	Š	Š	44.91		46.1	45.3
1.12 1.23 1.06 1.07 1.3 1.12 1.12 ND 1.12 20.76 23.02 21.68 22.01 20.9 19.67 ND ND 21.4 1.18 1.07 1.36 ND ND 21.4 1.36 ND ND 21.4 1.36 ND ND 1.7 0.43 0.33 0.87 0.87 0.73 0.86 ND ND 0.86 ND 0.24 0.22 0.21 0.3 0.35 0.25 0.35 ND 0.24 0.24 0.46 0.89 0.89 ND ND 0.45 ND 1.53	ດ້	23.1	24.62	23.19	23.37	22,98	23.97			2	000
20.76 23.02 21.68 22.01 20.9 19.67 ND ND 21.4 1.18 1.07 1.85 1.91 1.44 1.36 ND ND 1.7 0.43 0.33 0.87 0.87 0.73 0.86 ND ND 0.86 0.22 0.21 0.3 0.3 0.25 0.25 0.36 ND 0.24 2.39 2.22 2.3 2.32 1.92 2.11 2.05 ND 2.2 0.47 0.53 0.48 0.46 0.89 ND ND 0.45 ND ND ND ND 1.53	_~	1.12	1.23	1.06	1.07	£.	1.12			i	-
1.18 1.07 1.85 1.91 1.44 1.36 ND ND 1.7 0.43 0.33 0.87 0.87 0.73 0.86 ND ND 0.86 3 0.22 0.21 0.3 0.3 0.25 0.25 0.38 ND 0.24 2.39 2.22 2.3 2.32 1.92 2.11 2.05 ND 2.2 0.47 0.53 0.48 0.46 0.89 0.89 ND ND 0.45 ND ND 1.78 1.83 ND ND ND 1.53	o _	20.76	23.02	21.68	22.01	20.9	19,67			21.5	- 5
0.43 0.33 0.87 0.87 0.73 0.86 ND ND 0.86 0.22 0.21 0.3 0.25 0.25 0.38 ND 0.24 2.39 2.22 2.3 2.32 1.92 2.11 2.05 ND 2.2 0.47 0.53 0.48 0.48 0.89 ND ND 0.45 ND ND 1.78 1.83 ND ND ND 1.53	0	1,18	1.07	1.85	19.1	1.44	1.36			4.7	, .
0.22 0.21 0.3 0.25 0.25 0.38 ND 0.24 2.39 2.22 2.3 2.32 1.92 2.11 2.05 ND 2.2 0.47 0.53 0.46 0.89 0.89 ND ND 0.45 ND ND 1.78 1.83 ND ND ND 1.53	Q :	0.43	0.33	0.87	0.87	0.73	0.86			0.86	. C
2.39 2.22 2.3 2.32 1.92 2.11 2.05 ND 2.2 0.47 0.53 0.46 0.46 0.89 0.89 ND ND 0.45 ND ND 1.78 1.83 ND ND ND ND 1.53	o_	0.22	0.21	0.3	0.3	0.25	0.25			0.24	0.26
0.47 0.53 0.46 0.89 0.89 ND ND 0.45 ND ND 1.78 1.83 ND ND ND ND 1.53		2.39	2.22	2.3	2.32	1.92	2.11			2.2	2.2
NO 1.78 1.83 NO NO NO NO 1.53	ς.	0.47	0.53	0.48	0.46	0.89	0.89			0.45	0.46
	•	2	S	1.78	1.83	오	2			1.53	1.40

TABLE B-6. INDIVIDUAL LABORATORY ANALYSES OF ROUND ROBIN SAMPLE O

PPM DRY WHOLE COAL BASIS

## ULTIMATE ## UL	TRACE	_ : :	AB 1		AB II	LAB	=	148		_	V 8 V
Heart Hear	LEMENIO	Z D	HON 2	NON THE	RUN 2	NOE -	NON N	NON T	RUN 2	RUN 1	RUN 2
9941 7478 585 62.38 73 77 72 80 545 545 528 73 24 21 226 237 2.25 1.9 2.03 2.7 2.4 2.1 2.1 2.4 2.1 2.1 2.4 2.1 2.1 2.4 2.1 2.1 2.4 2.1 2.1 2.4 2.1 2.1 2.4 2.1 2.1 2.4 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	•	46.12	35.85	34.96	36.04	23		27	S	20.4	ē
S3.29		99.41	74.78	58.5	62.38	73		2	2	24.5	, c
297 225 19 2.00 2.7 2.4 2.1 2.4 2.50 22.55 18.44 20.66 19.39 2.1 22.6 2.0 2.0 11.3 22.55 18.44 20.66 19.39 2.1 22.6 2.0 2.0 11.3 22.57 18.44 20.66 19.39 2.1 22.6 2.0 2.0 2.1 2.4 22.58 18.44 20.24 0.023 0.223 0.22 0.2 2.2 2.2 22.64 21.51 27.2 24.6 27.4 0.04 30. ND		53.29	48.15	84.8	86.2	107		i K	8	3	0. 4
2255 16.44 20.06 0.14 0.19 2255 16.44 20.06 0.12 0.02 0.20 0.20 0.20 0.10 0.10 0.14 0.13 0.24 0.23 0.23 0.20 0.20 0.10 0.14 0.13 0.246 0.273 0.20 0.20 0.20 0.2 0.2 0.2 0.2 0.2 0.2		2.97	2.25	1.9	2.03	2.7		12	\$ C	0 84 84	6
22.55 (18.44 20.66 19.39 21 22.6 20 20 13.3 2.3	_	0.11	90.0	0.14	0.13	<0.3		4.0×	400	2.30	- CN
874 8-12 5-8 6-16 6-67 772 8 7 46 2357 16-44 1781 1 5-8 6-16 6-67 772 8 7 46 0.01 0.1 6003 66-12 90 90 ND ND 73 2014 0.24 0.246 0.273 0.23 0.23 0.2 0.2 0.29 2015 25-3 4.05 4.09 5.09 5.66 4.6 1.65 2026 21-15 11-12 11-12 11-12 11-12 11-12 11-12 11-12 2.15 14-3 2.09 2.17 15-9 19 19 19 10 10 10 10 10 10 10 10 10 10 10 10 10		22.55	18.44	20.68	19,39	2		5	5 6	- 6	<u> </u>
1975 1974 1761 1662	•	9.74	9.12	5.9	6.16	6.67		.	3 ~	. 4	
MATE & ULTIMATE 0.01 0.01 0.02 0.0	_	23.57	18.44	17.81	18.62	<31		20	. 60	20.00	9 60
Cold		0.01	0.1	80.03	68.12	8		12	įŞ	73	73
2664 2151 272 246 274 304 30 31 26 27	•	0.14	0.3	0.248	0.273	0.23		0.2		0000	24.0
10.25 5.33 4.05 4.09 5.09 5.66 <6 <6 1,85 27.67 21.51 21.12 22.1 54.5 61.9 26 25 23.7 21.5 29.94 11.27 15.29 21.7 1.65 11.70 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	_	26.64	21.51	27.2	24.6	27.4		90	100	6 K	2000
2767 2151 21.12 22.1 54.5 61.9 26 25 23.7 215 11.27 15.29 15.14 17 20 19 16 10.5 2.15 2.15 3.39 3.37 2 3 3 2.1 2.6 1.9 16 10.5 2.15 2.15 3.39 3.37 2 3 3 2.1 2.6 2.5 3.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2	•	10.25	5.33	4.05	4.09	5.09		9	• • • • • • • • • • • • • • • • • • •	1 8 5	2.0.4
994 1127 1529 15.14 17 20 19 10.5 2.15 1.43 2.09 2.17 1.85 1.79 2 2 2 2 2 2 2 2 2 3 3 3.7 3.2 3 3.7 3.5 3.7 3.8 3.2 3.7 3.8 3.2 3.8 ND 3.3 3.8 44.07 33.6 26.47 30.13 32.3 32.1 22 6 2.6 35.6 IMATE & ULTIMATE ON 696.1 69.56 71.35 71.16 71.19 71.46 70.38 70.79 70.5 30.6 5.24 4.82 4.76 4.91 1.37 1.36 1.39 1.33 1.34 1.47 1.41 1.37 1.36 1.30 1.33 1.31 1.34 1.47 1.41 1.37 1.36 1.30 1.33 1.34 1.47 1.41 1.37 1.36 1.30 1.33 1.34 1.47 1.41 1.37 1.36 1.30 1.33 1.34 1.47 1.41 1.37 1.36 1.30 1.32 1.32 1.32 1.32 1.32 1.32 1.32 1.32		27.67	21.51	21.12	22.1	54.5		26	2, 25	23.7	8.7.3 7.4.4
2.15 1.43 2.09 2.17 1.65 1.79 2 2 2.6 2.05 2.15 3.39 2.37 2 3 3 3 1.70 2 2 2.6 4.07 33.6 26.47 30.13 32.3 32.1 28 2 2.6 S. DRY BASIS IMATE & ULTIMATE ON 69.61 69.56 71.35 13.3 13.28 13.4 13.12 13.10 13.3 10.0 ON 69.61 69.56 71.35 71.16 71.19 71.46 70.38 70.79 70.5 OGEN 5.06 5.24 4.82 4.76 71.19 71.46 70.38 70.79 70.5 OGEN 5.06 3.1 13.4 14.7 14.1 13.7 13.6 13.0 13.3 OGEN 5.06 3.1 2.92 2.97 3.02 2.97 3.01 3.04 2.89 INTA 11530 12.72 12.72 12.65 12.690 12.70 INTA 11530 12.72 2.057 2.057 21.3 ND 0.12 OGEN 52.86 39.14 46.16 46.9 ND 42.89 ND 45.3 24.76 20.13 24.76 20.13 24.76 20.13 24.76 20.13 24.76 20.13 24.76 20.13 24.76 20.13 24.76 20.13 24.76 20.13 24.76 20.13 24.76 20.14 22.80 20.10 1.02 2.37 IND 0.37 0.44 0.86 0.87 0.83 0.25 0.25 0.26 ND 0.47 24.9 ND ND ND 1.74 ND ND 1.63 1.75 ND ND ND 0.04 OGEN 1.09 1.09 ND ND ND 1.74 OGEN 1.09 ND ND 1.74 OGEN 1.09 ND ND 1.74 OGEN 1.09 ND ND ND 1.74 OGEN 1.09 ND ND ND ND ND 1.74 OGEN 1.09 ND	•	9.94	11.27	15.29	15,14	17		19	4	+ C +	64.0
2.05 2.15 3.39 3.37 2 3 3 ND 3.3 44.07 33.6 28.47 30.13 32.3 32.1 29 26 26 35.6 IMATE & ULTIMATE ON 69.61 69.56 71.35 71.16 71.19 71.46 70.39 70.79 70.5 OGEN 5.06 5.24 4.62 4.76 71.19 71.46 70.39 70.79 70.5 OGEN 1.3 1.34 1.47 1.41 1.37 1.36 1.38 1.33 OGEN 5.06 0.02 0.13 0.13 0.12 0.13 ND ND 0.12 IT774 11530 12737 12720 12654 12655 12690 12708 12644 K ASH ELEMENTS 52.86 39.14 46.16 46.9 ND A 2.89 ND A 5.3 1.29 0.96 1.09 1.08 1.03 1.02 2.32 ND ND 2.1 1.19 0.97 1.18 1.31 1.32 1.32 0.25 0.27 ND ND 2.1 1.19 0.97 1.18 1.31 1.32 1.32 0.35 0.36 ND 0.47 0.37 0.39 0.47 0.39 0.47 0.47 0.48 0.86 0.47 0.48 0.48 0.47 0.48 0.48 0.47 0.47 0.48 0.48 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.48 0.47 0.47 0.47 0.47 0.47 0.47 0.47 0.47	۰	2.15	1,43	2.09	2.17	1.85			, <i>o</i>		70
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TABLE B-7. COMPARISON OF BOILER FEED COAL RESULTS WITH ROUND ROBIN RESULTS

Analyte	Average Table 5-6 Result (ug/g, as received)	Average Table 5-6 Result (ug/g, dry)*	Average Round Robin Result (F/O) (ug/g, dry)	Relative Percent Difference
Aluminum	14067	15052	15925	6
Antimony	11	1.18	921	58
Arsenic	33	35	26	30
Barium	55	59	76.1	26
Beryllium	1.9	2.03	2.37	15
Boron	72	77	70.7	9
Cadmium	NDS0.3	ND<0.32	0.085	118
Chromium	16	17	20	16
Cobalt	6.3	6.74	6.95	3
Copper	15	16	21.2	28
Lead	13	14	13.6	2
Manganese	25	27	26.5	1
Mercury	0.21	0.22	0.26	15
Molybdenum	ND<3	ND83.21	4,54	4
Nickel	18	19	28.2	38
Potassium	2067	2212	2405	8
Selenium	ND×0.6	((DK0)84)	2.59	9 2 49
Silicon	24567	26287	28499	8
Sodium	300	321	297	8
Titanium	800	856	976	13
Vanadium	28	30	34	13

^{*}Calculated using average moisture value of 6.5 percent for boiler feed coal.



RESEARCH TRIANGLE INSTITUTE

RTI/5960/193 - 07D

August 12, 1993

QA/QC AUDITS ON DOE UTILITY BOILER TEST PROGRAM FIELD SAMPLING AUDIT REPORT

Site: Niles Station Unit 2, Niles, OH

DOE Contractor: Battelle

DOE Project Officer: Robert Evans

Performed for

Joseph A. McSorley
EPA Work Assignment Manager
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

Prepared by

Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709

RTI Work Assignment Leader: Shirley J. Wasson

Under EPA Contract No. 68D10009 Work Assignment No. I-193

POST OFFICE BOX 12194 RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709-2194

Field Audit of:

Niles Station Unit 2 Ohio Edison Niles, OH

Contractors: Battelle Memorial Institute

Chester Environmental

Dates: July 20 and 21, 1993

RTI Personnel: J.B. Flanagan and L.L. Pearce

Introduction

Niles Station Unit 2 is owned and operated by the Ohio Edison system and is located adjacent to the Mahoning River just south of Niles, Ohio. Unit 2 is a cyclone coal-fired boiler, burning bituminous coal from various sources. The coal has an average sulfur content of 3.0 percent. Typical gross electrical generation at full load is 100 MW. To maintain full load, four star-valve feeders supply approximately 44 tons per hour of coal into four burners. Approximately 20 to 30 percent of the ash in the coal is fly ash. An electrostatic precipitator (ESP) is the principal control for entrained fly ash. The rest of the ash, approximately 70 to 80 percent, is retained as molten slag in the bottom of the boiler and then drained into a tank filled with water.

A slipstream exits unit 2 prior to the ESP and is routed to the Innovative Clean Coal Technology Wet Gas Sulfuric Acid - Selective Catalytic Reduction of NO_x (ICCT WSA-SNOX) pilot plant managed by ABB Combustion Engineering. The WSA-SNOX process provides SO₂ and NO_x control on 35 percent of the flue gas from unit 2. There are no SO₂ or NO_x control systems for the remaining 65 percent of the flue gas. The WSA-SNOX process uses a selective catalytic reactor for the removal of NO_x and an SO₂ catalytic reactor in sequence with a cooling tower to convert SO₂ to sulfuric acid.

During the audit, the Niles plant had repeated operational problems with one of the four coal feeders. On Tuesday, July 20, sampling was postponed because of this problem. By 1:00 p.m. on Wednesday, July 21, this had been resolved, and a full day of organic sampling commenced. Thus, the entire sampling schedule was shifted.

Despite the schedule change, the auditors were able to complete all performance evaluation audits (PEAs) and audit questionnaires. In addition, more time was available on Tuesday and on Wednesday morning to interview the sampling personnel and to examine records. The auditors departed the site at approximately 6:00 p.m. on Wednesday.

Findings

1. Finding: Particulate fractions data may be compressed because cyclones were operated in an extractive mode instead of in the stack. In-stack sampling could not be performed because the ports were too small to allow the cyclones to pass through. Obtaining the sample required a sample probe and flexible Teflon line. According to Tom Kelly, up to 15 feet of tubing (probe length plus flexible line) were needed when performing a full traverse. When performing single-point sampling, shorter tubing runs were used. Battelle will wash the probe and lines to recover any particulate material lost.

Effect on Data: Extractive versus in-stack cyclone sampling may lead to different results because of particle loss in the probe and lines. Depending on the gas flow rate, tubing diameter, tubing length, and aerodynamic diameter particle loss will vary.

Rinsing the probe and flexible line is a good idea, but assigning all of this material to the first size fraction is questionable. See the Recommendation section of this report for a suggested investigation that might help clarify this issue.

2. <u>Finding:</u> Glass cyclones of new design were used to collect particulate for size-fractionated analysis of metals. According to George Sverdrup, these cyclones were of an original Battelle design and were developed specifically for this program and fabricated only weeks prior to the Niles field testing.

Effect on Data: Unknown. Using all-glass cyclones should eliminate the chance of metal contamination that is possible with the use of metal cyclones, but because the cyclones were fabricated only a few weeks before the test, it is not known if validation testing was adequate.

3. Finding: On one of the probes operated by Battelle, there was insufficient insulation to shield the thermocouple that controlled the temperature of the probe at 250°F from the high temperature flue gas. Consequently, when the thermocouple entered the duct, approximately half-way into the traverse, the temperature controller shut down thereby allowing the portion out of the stack to drop below 250°F. In Figure 1, the controller is controlling the probe heater to heat the probe to 250°F. In Figure 2, the controller is turned off. The probe inside the duct is at a high temperature, ~380°F, while the probe outside the duct is at a lower temperature, ~198°F, measured by Battelle.

Effect on Data: A few feet of the probe below 250°F seems unlikely to cause significant problems. This probe, operated at sampling point #19, should be compared with the probe at point #18 (which had adequate insulation) for evidence of any unexpected difference in probe rinse concentrations due to condensation in the unheated section.

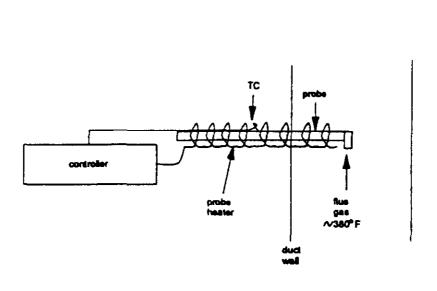


Figure 1. Thermocouple outside duct.

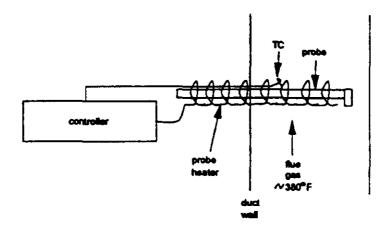


Figure 2. Thermocouple inside duct.

4. Finding: The use of old absorbing solution in the Fyrite oxygen analyzers may have led to low oxygen results during the performance evaluation audit (PEA). During the Fyrite oxygen analyzer PEA with analyzer set #1, the oxygen analyzer measured oxygen 24 percent low compared to RTI's standard gas cylinder. The second oxygen analyzer measured oxygen approximately 3 percent lower than RTI's oxygen standard. It was determined that the source of error may have been the use of old absorbing solution in the analyzer.

Effect on Data: Even though Chester Environmental checked the Fyrite #1 periodically with ambient air, the oxygen analyzer continued to give erroneous results when challenged with a standard oxygen concentration. Checks of the Fyrite against a standard on a regular basis should be performed and the absorbing solution should be regularly replaced to prevent measuring incorrect oxygen concentrations at the flue gas sampling locations. Accurate oxygen measurements are necessary in determining the air in-leakage at the flue gas sampling locations for flue gas molecular weight calculations.

5. Finding: The field balance used to weigh impinger solutions, drierite, etc., was not being calibrated using NIST-traceable weights. Section 5.1.2.1, "Field Sampling Equipment," of the Sampling/Testing and QA/QC Plan states, "Field checks of balance accuracy will be made daily using a set of QC weights which have been weighed side-by-side with NIST-traceable weights."

Effect on Data: This will have minimal effects on data because none of the weighings are used for analytical measurements. This balance was not used for weighing filters, impactor catch, or any other critical measurements.

6. <u>Finding:</u> Water used for washing and making impinger solutions was a commercial brand of unknown chemical composition.

Effect on Data: The water should be carefully tested for the presence of any of the target analytes. If results show no contamination, or if background levels can be subtracted, there should be minimal impact on data.

7. Finding: Glassware used by Battelle's subcontractor, Chester Environmental, for aldehyde analysis was of a different size than that used by Battelle. Battelle used midget impingers, while Chester used full-size impingers.

Effect on Data: Differences will probably be minimal, but without side-by-side comparison information, it would be impossible to be certain that the data are exactly comparable.

8. <u>Finding:</u> There appeared to be some bleaching of the DNPH solution, particularly the second DNPH impinger, possibly due to the high levels of SO₂.

Effect on Data: Unknown. See recommendations section for a suggested investigation.

9. Finding: Baghouse ash may have been contaminated by the sampling device.

Battelle employed a painted steel tube within a tube device for sampling baghouse ash.

Ash samples were obtained by inserting the device into the ash hopper, collecting the ash sample, and dispensing the collected sample into an amber jar. Auditors noticed a few spots where the black enamel paint had flaked off the tube and rusty metal was exposed.

Effect on Data: Sample contamination could result. The effect on the data is unknown, but trace metals analyses for these samples should be reviewed for any evidence of contamination.

10. Finding: Sampling of the baghouse ash may not have been representative.

Baghouse ash was sampled from three of the six ash hoppers. This sampling configuration resulted from an obstructed sampling port for one of the ash hoppers.

Effect on Data: Battelle assumed that all six hopers held identical material and the sampling ash from three hoppers was a representative sample of baghouse ash. Each of the ash hoppers will contain identical material given that there is a uniform flow of flue gas through the compartment of the baghouse and a uniform distribution of particles in the flue gas.

Auditors observed a 90-degree elbow in the duct at the baghouse inlet. This sharp bend in the ductwork could cause some gas flow disturbances and result in uneven particle distribution. Since the velocity traverses are unable to be performed at this location, the discovery of any effects of this disturbance are pending laboratory analysis.

Observations

- 1. No grease was used with Battelle's sampling trains. Because train components had been preselected for good fit, leakage was held to a minimum. Chester appeared to use Teflon tape on some of the ground glass joints in their trains to minimize leakage.
- 2. The sampling ports that had been provided in the SNOX facility ducts were only about 2 inches in usable diameter. This limited the diameter of probes used and prevented in-stack use of larger devices such as cascade impactors and cyclones. Battelle and

Chester were well-prepared for most potential problems resulting from the small port openings; however, comparison of these data with those obtained at other sites may reveal differences due to extractive versus in-stack sampling.

3. Field personnel did not know if any single data base would be used to manage the analytical data. If a laboratory audit is performed, it would be a good idea to audit data transfers between the data bases.

Recommendations

- 1. The field balance should be checked daily with NIST-traceable weights. Checks should be recorded in the log book.
- Water analyses, including reagent blanks for the impinger solutions made with the Magnetic Springs water, should be presented in the QC section of the final report.
- 3. The observed bleaching of DNPH solutions should be investigated. It is especially important to verify (1) that high levels of SO₂ or NO_x do not degrade the adducts after they are formed, and (2) that unreacted DNPH is not degraded to such an extent that there is incomplete capture of the aldehydes and ketones. Stack conditions could be recreated in the laboratory to investigate the reactivity of DNPH and adduct solutions with high SO₂ gas, high NO_x gas, and zero air.
- 4. A computer model should be run to estimate the amount of particulate material lost in the tubing between the sampling nozzle and the cyclones outside the stack. Results of size-fractionated chemical analysis should be corrected based on modeling results and probe and tubing wash data.
- 5. The all-glass cyclones fabricated by Battelle should be subject to validation testing since they are of a new design. Important considerations include accuracy of calculated cutpoints, presence of any static charge buildup on the nonconductive glass surfaces, and losses in the sample probe and flexible line leading from the duct to the cyclone.
- 6. Battelle should assure that Chester checks the Fyrite oxygen analysis against a standard on a regular basis and that the solutions are changed to appropriate intervals.

Activities

1. Performance Evaluation Audits (PEAs)

All scheduled PEAs were performed for the following:

- Paramagnetic oxygen sensors
- Fyrite oxygen analyzers
- Aldehydes
- Trace metals
- PAHs
- VOST
- Dry gas meter/standard orifice
- SO₂ and NO_x (ABB SNOX monitors)

The results of the paramagnetic oxygen sensor PEA, the Fyrite oxygen analyzer PEA, and the CEM PEA are shown in Tables 1 through 3. Chester Environmental's dry gas meter audit results were within 2 percent of the standard critical orifice measurements. Battelle's dry gas meter audit data had not been received as of August 2, 1993. Sandy Anderson, the QA Officer, was contacted concerning the missing information.

2. Technical Systems Audits (TSAs)

Because of plant operational problems, not all sampling trains were observed; however, all basic activities including traverses, glassware and train preparation, and recoveries were observed. Recovery of material from the cyclones was not observed because the auditors were not present on an inorganics test day. Some additional calibration data not present at the site were requested.

Personnel Present During Site Visit

	Name	Organization	Telephone
	Robert Evans	DOE	
	George Sverdrup	Battelle	(614) 424-5014
	Paul Webb	Battelle	(614) 424-5014
Tom	Jelin Kelly	Battelle	(614) 424-3495
	Debbie Smith	Battelle	(614) 424-4114
	Joe Tabor	Battelle	, ,
	Raj Rangaraj	Battelle	
	Sandy Anderson	Battelle	(614) 424-5220
	John Hilborn	Ohio Edison	(216) 384-5768
	Mark Grunebach	Chester Environmental	•
	Timothy Cassell	ABB	(216) 652-4881
	Jim Flanagan	RTI	(919) 541-6417
	Lori Pearce	RTI	(919) 541-7182

TABLE 1. PARAMAGNETIC OXYGEN SENSOR PEA RESULTS

	RTI (Audit Standard)	Battelle	% Difference*
Model 570A	Serial No. X-48490		
Zero (pure N ₂)	0.0	-0.2	
O ₂ (%)	9.21	9.10	-1.20
Model 580A	Serial No. X-43454		
Zero (pure N ₂)	0.0	0.0	
O ₂ (%)	9.21	9.00	-2.30

^{*} Acceptance limits were not provided in the QA Plan. A reasonable acceptance limit of ± 10% was used by RTI in evaluating the PEA data.

TABLE 2. FYRITE OXYGEN ANALYZER PEA RESULTS

	RTI (Audit Standard)	Chester Environmental	% Difference*
Set #1			
Zero (pure N ₂)	0.0	0.0	4
O ₂ (%)	9.21	7.00	-24.0
Set #2			
Zero (pure N ₂)	0.0	0.0	
O ₂ (%)	9.21	8.95	-2.82

^{*} Acceptance limits were not provided in the QA Plan. A reasonable acceptance limit of ± 10% was used by RTI in evaluating the PEA data.

TABLE 3. SNOX CEM AUDIT RESULTS

	RTI (Audit Standard)	ABB	% Difference*
O ₂ (%)	9.21	9.02	-2.10
SO ₂ (ppm)	1549	1555	0.40
NO _x (ppm)	815	810.5	-0.55

^{*} Acceptance limits were not provided in the QA Plan. A reasonable acceptance limit of ± 10% was used by RTI in evaluating the PEA data.

INTERNAL AUDIT REPORT

on

A STUDY OF TOXIC EMISSIONS FROM THE NILES STATION BOILER NO. 2 AND WSA-SNOX PROCESS

to

U. S. Department of Energy Pittsburgh Energy Technology Center

(Contract DE-AC22-93PC93251)

Prepared by

Sandra M. Anderson Quality Assurance Officer Battelle 505 King Avenue Columbus, Ohio 43201

INTERNAL AUDIT REPORT

on

A STUDY OF TOXIC EMISSIONS FROM THE NILES STATION BOILER NO. 2 AND WSA-SNOX PROCESS

INTRODUCTION

This report summarizes the audit activities conducted on-site at Ohio Edison's Niles Station WSA-SNOX demonstration project and at Battelle Columbus Laboratories from the time period of July 19 through October 11, 1993. As Project Quality Assurance Officer (QAO), I observed field sampling and laboratory activities which were compared to descriptions provided in the Management Plan for 'Study of Toxic Emissions from a Coal-Fired Power Plant Demonstrating the ICCT WSA-SNOX Project and a Plant Utilizing an ESP/Wet FGD System' (DOE Contract DE-AC22-93PC93251) dated June 21, 1993, and the 'Final Niles QA/QC, Sampling, and Analytical Plans', dated July 17, 1993, under the same contract number.

During these observations, I recorded detailed notes which are summarized on the attached Checklists including general information (date, place, time, what, who), a brief narrative account, sample collection and related procedures, comments and recommendations. All of the recommendations were discussed in real-time with either the Project Manager, Assistant Project Manager, Field Sampling Manager, or Analysis Leader as soon as possible after the observation. Corrective action was implemented in most instances before the QAO left the inspection site or within a reasonable time length thereafter.

SUMMARY

Field and laboratory inspections conducted during Niles Station, SNOX Process

Power Plant activities indicated that, for the most part, the QA/QC Plan of July 17 was being followed as written, or according to formal, written deviations as described in 'Technical Note, Volume 1 of 3 - Sampling' dated November 1993. These deviations were initiated

either as a need for corrective action or because the technical and physical demands of field and laboratory operations precluded adhering to the original QA/QC Plan.

On-site field observations included: sample tracking, custody, storage, and shipping procedures; in-process sampling at Locations 20, SCR Reactor Outlet; 19, Baghouse Outlet; and 18, Baghouse Inlet. SNOX Process sampling was observed at Locations 1 (Boiler Feed Coal), 24 (Baghouse Ash), and 22 (Sulfuric Acid). Various sampling train recovery and preparation procedures were also observed.

The Battelle QAO also served as a point of contact, along with the Project Manager and Field Sampling Manager, for RTI personnel conducting an independent field audit on July 20-21, 1993. In the absence of the Field Sampling Manager, subsequent to the field sampling phase, the QAO provided the following to RTI Auditor L. Pearce: type S Pitot tubes calibration sheets dated July 13; completed Multimetals Train data sheets from sampling Location 19 (Run N-19-MUM-722) as requested by RTI's Jim Flanagan; nozzle calibration data forms dated 06/12/93 and 07/26/93, including one for Chester nozzle 54; and continuous instrument calibration data forms for Servomex 580A instrument (dated 07/24/93) and Servomex 570A instrument (dated 07/20/93). These are described in a letter to Ms. Pearce dated August 9, 1993.

Laboratory observations included: sample receipt, log-in, custody, and storage procedures; PAH/SVOC liquid samples extraction and concentration; systems audit of VOC-Canister sample receipt and analysis; anion analysis by ion chromatography and data tracking; PAH/SVOC liquid samples preparation; PAH/SVOC gas and liquid samples, filter preparation; PAH analysis by GC/MS and Dioxin/Furan analysis by GC/MS.

Following is a sequential account of Niles Station SNOX Process audit activities, each with a brief narrative and QAO's recommendations when applicable. For detailed records, dated observations recorded on either the Field Inspection Checklist or Laboratory Inspection Checklist should be consulted.

CHRONOLOGY

Sampling Day 02, 19 July 1993:

Observations: Process Sampling for Boiler Feed Coal at Location 1. Half-hour process samples were collected from each of the coal feeders with a painted, metal scoop into a cleaned coffee can and subsequently emptied into a plastic bag for compositing. Random-sized coal pieces are left in the sample collection. Impinger and train recovery procedures were observed for cyanide and multimetals, Location 19 baghouse outlet; and particulate filter recovery for Location 18, baghouse inlet. Impingers and trains arrived at the recovery sites on ice and connections were wrapped with tape when applicable. Rinsing, container, and collections procedures followed the QAP; Method 29 filter holder was brushed and wiped out, and reloaded for use at the same site location. Container labels and chain-of-custody forms were completed. Location 20, SCR reactor outlet, in-process sampling conducted by Chester staff, was observed as well as the sample preparation trailer used by the subcontractor team. Horizontal traverses as well as temperature and meter readings were noted.

Recommendations: Use of a painted scoop for boiler feed coal samples was discussed with the on-site Project Manager. Niles staff were requested to provide overnight sample custody for collected samples and to initial the last day's collection on the data form for traceability. Excursion from the QAP pg. 5.2-18 description of collecting into "precleaned glass bottles" must be addressed as a deviation. Sample custody and transfer must be clarified for times when samples are being transferred and the designated sample custodian is fulfilling sample collection obligations (three times daily samples for baghouse ash, Location 24). Individuals responsible for train recovery should also be clearly identified. Data sheets from sampling locations were observed with either no clock times for start/stop or names recorded were noted and this was discussed with the field sampling manager immediately.

Issues above were discussed during the second sampling day with Project Manager Sverdrup and Field Sampling Manager Tom Kelly. A formalized list of deviations was to be initiated and will be updated as needed, to describe departures from the QAP and the impact of the changes on the study.

Response: The deficiencies in documentation of data sheets, sample recovery, and sample custody were addressed immediately following the QAO's comments by directions and reminders to the pertinent staff in the field. The coal collection device caused no contamination of the coal samples, due to the large sample size collected and the lack of damage to the device itself. Use of plastic bottles has been noted as a deviation from plan in the Draft Final Reports on the Niles sampling.

Canceled Sampling Day, 20 July 1993:

Observations: Process sampling from baghouse ash Location 24 was observed early in the day. However, because of sampling program cancellation due to plant problems, this was the only process sample collected on this day. Time was dedicated to the accommodation of the RTI performance audit activities. This included oxygen meter checks with standard cylinders provided by RTI; spiking of XAD-2 traps and filters; initiation of dry gas meter audits for Locations 18 and 19, using an EPA standard orifice supplied by RTI. A detailed examination of the sample processing, custody, and shipping procedures was conducted by the Battelle QAO.

Recommendations: There was no standard calibration form available on site for either Battelle or the subcontractor on which to record results of the RTI audit. Discussed data entry correction procedure with the Field Sampling Manager to eliminate obliterations of corrected values on sampling data forms. Situation was discussed with the custodian and train recovery leader in which filters prepped after recovery late on 07/19 were properly stored and labelled but were not logged onto the chain-of-custody form by mid-day of July 20.

Response: Further discussions were held with field staff responsible for the sample documentation and custody. The minor lapses still found in these areas were due to the conditions of field work and the large numbers of samples being logged in.

Sampling Day 03, 21 July 1993:

Observations: RTI staff continued the conduct of their performance audit. The Battelle QAO reviewed sample packaging and shipping procedures. "Cold" samples such as impinger solutions, XAD-2 traps, VOCS and SVOCs are shipped out daily on ice via courier. Process coal and preserved samples are shipped back to labs at the conclusion of sampling. VOC SUMMA canisters are shipped out within 24 hours of collection. All sample container labels are covered with clear tape, the containers wrapped in bubble wrap and double plastic bags for shipment. Receipt and temporary storage of Chester VOST tubes were observed. Baghouse inlet sampling at Location 18 was initiated with a dry gas meter calibration ongoing while the sampling team was setting the probe in place for the first of 22 vertical traverse sampling points. The second sampler was setting up for a horizontal traverse. Baghouse outlet sampling at Location 19 included setting up of the Nutech Stack Sampler, a critical orifice check and set up of the aldehyde impinger on the lower platform. The vertical traverse probe was already set up for the first sampling point. Transfer of SUMMA canisters to Locations 18 and 19 with chain-of-custody forms and cross check of canister identification tags were noted (88-044, 89-005, 88-033). Sulfuric acid sampling at Location 22 by ABB staff was observed from the tank under the SNOX tower. The sample was collected into a precleaned and labelled amber glass bottle and constituted the daily sample. RTI's spiking of two aldehyde trains was noted.

Recommendations: There were no additional recommendations for sampling day 03 observations.

A verbal debriefing was conducted by RTI and included the following highlights:

Battelle is using bottled DI water that does not meet method requirements for ASTM Type II water. Even though blanks are run, consideration should be given to using bottled ASTM water. There is concern over use of a painted metal scoop for the coal feeder Location 1 process samples. The oxygen analogue meter was noted to be out of specified calibration ranges. There are differences in the aldehyde train connections: Battelle uses dry connections and a different sized impingers than Chester, which uses Teflon tape on ground glass joint connections. Fyrite tubes Chester is using must have a once/day standards check

for accuracy. Additional minor points included whether quartz or glass filters were used for dioxin sample collection since the QA Plan didn't specify, and a question as to how glass end caps for sampling trains were stored during sampling.

Response: Most of the items noted in the RTI debriefing have been addressed in the Draft Final Reports on the sampling studies conducted at the Niles-SNOX and Niles Boiler No. 2. In both reports, responses to the RTI comments are presented in Appendix B: Auditing. Quartz fiber filters were used for all sampling. Glass end caps were covered in aluminum foil or kept in plastic bags during sampling.

Sample Receipt and Log-in, July 29, 1993

Observations: Samples for N 5a MUM 727, N 4 MM5 728, N 13 PRL, and N 8 PRS samples were tracked from evening delivery to the Battelle lobby, transfer by the Laboratory Sample Custodian to the receipt and log-in area, to final storage locations prior to preparation and analysis. Three coolers and seven boxes of liquid, solid, and filter samples were cross-checked between container label information and completed chain-of-custody forms prior to being logged into the custodian's record book.

Recommendations: Several discrepancies from the sampling aspects of the QA/QC Plan were noted and discussed with the Custodian and the Field Sampling Manager. Certain of these are to be addressed as deviations to the QA/QC Plan; others for which subsequent data were completed to assure traceability of samples and completeness of the sampling record, should be addressed for future studies by more vigorous training of field staff prior to departure for the sampling site. QAP pg. 5.2-22 specifies 4-liter bottles for collection of samples from Locations 9, 10, and 13. 500-ml amber glass bottles of samples were received from these sites. Location 9 'river water' is referenced as 'makeup water' in the QAP. Sequential samples for N 13 PRL 729 and others were noted with identical labels for all four containers. Subset identifiers should be added for traceability for this type of replicate sampling, which is not spelled out in the QAP. Discrepancies in sampling times between the container labels and completed chain-of-custody forms varied from a few minutes to an hour. Certain sampling team members used only their first names on forms and labels. The

Laboratory Sample Custodian documented labelling and sample container discrepancies on both the custody form and the sample record logbook.

Response: As noted, some discrepancies were observed in documentation of samples. However, all such discrepancies were resolved in the chain-of-custody review process prior to sample analysis, and all samples were identified and accounted for. Improvements in the sample numbering scheme will be made in any future work. The collection of liquid samples is noted as a deviation from plan in the Draft Final Reports on the Niles sampling efforts.

PAH/SVOC Liquid Samples Extraction and Concentration, 04-05 August 1993

Observations: Method 3510 was followed for extraction, pH adjustment, spiking, and concentration. Spiking and surrogate solutions are traceable to neat stocks. Samples were labelled properly through the 2-day process and custody procedures observed through final transfer to the analyst. N 9 PRL 730 samples for pond water, river water, trip, and field blanks were tracked for this observation.

Recommendations: There were no recommendations for these observations.

VOC-Canister GC/MSD Analysis, 05 August 1993:

Observations: A system audit was conducted of VOC-canister analysis, from transfer to the analyst by the Lab Sample Custodian, instrument calibration with a 42-component NIST-traceable standard, sample analysis, data acquisition and review, and transfer to canisters for recleaning. VOC canisters are shipped within 24 hours of field collection and the analysis is initiated the next morning after sample receipt to maintain the holding time limitation of 2 days.

Recommendations: Clarification of using a 42-component, rather than the QAP p. 4.1-14 'containing the 41 target compounds' should be added to the study record. This is not technically a deviation, however.

Response: The cylinder used for calibration contained 42 compounds; however, for this study, only 41 compounds were targeted for analysis.

Ion Chromatography Analysis, 11 August 1993:

Observations: Process water samples from 728 are received in 40-ml amber vials and the labels checked to the chain-of-custody form copy. Twofold dilutions of samples are made using a calibrated autopipettor. Standard, calibration, and spiking solutions are traceable to a separate logbook. EPA Method 300.0, December 1989, is used as a guideline. EPA PE Standard WP029 is used as an accuracy check solution for Dionex instrumentation. Sample custody is documented from receipt through analysis. The analyst reviews generated data and sets up a data file for each set of samples that includes: Final Anion Report, Summary Report, Calibration Plots, Duplicate and Spike Data, Standards Prep Data, Analysis Conditions and Chromatograms.

Recommendations: Minor clerical traceability issues were discussed with the analyst. Reference to the specific method guidelines used and brief description of the sample preparations should be added to the study record book.

Response: Reference to specific method guidelines and a description of the sample preparation procedure were added to the study record book.

PAH/SVOC Gas and Liquid Filter Preparation. 20 August 1993:

Observations: N F 730 samples for Locations 5a, 5b, and 4 were observed from initial custody transfer, through column chromatography, extraction, spiking with internal standard, concentration, and storage until analysis. Chromatographic reagent preparation and glassware preparation were discussed with the analyst. Sample labels reflect identity throughout the process and tracking documentation is also described in the study record book.

Recommendations: Calibration of the storage refrigeration unit thermometer was suggested, as well as a lock on the freezer where sample extracts are stored. The latter suggestion was implemented within the next day or two and alleviated the problem of unassured sample custody after working hours caused by a faulty door lock in the laboratory area.

Response: The storage refrigeration unit thermometer was calibrated as suggested.

PAH Analysis by GC/MS, 20 August 1993

Observations: Tuning, calibration, and analysis of the first sample extract was observed. A Battelle Facility SOP describes the analysis using the Finnegan MAT TSQ GC/MS. The instrument logbook records the sample ID, file ID, and laboratory record book reference number. Freezer for instrument standards is monitored. Sample analysis flow begins with an instrument tuning run, standard, standard, sample, sample, sample, standard at end of the run. The Lab Analysis Manager determines when corrective action is needed and also performs the action. Third party review of data and spreadsheet is performed before transfer of data for reporting.

Recommendations: No recommendations were made for this observation.

Dioxin/Furan Analysis by GC/MS, 11 October 1993

Observations: Samples are stored in a monitored freezer from transfer through analysis. MM5 Site 5a filter was tracked as a filter extract from the prep logbook to the Mass Spec logbook. Sample custody and transfer is also documented in the Dioxin Lab sample logbook. Five point recalibration is performed initially for the dioxin analysis, with continuing calibrations being performed at periodic intervals. Calibration standards are made up by the Standards Custodian from commercially available standards, as are window mix and column performance checks. The MS logbook documents operating parameters, as well as file ID, Lab ID, sample ID for cross reference, injection volume and clock time of injection. Instrument used is VG Analytical HP5890A GC, and 11-250J computer which was last validated on 07/07/93, according to the facility SOP. Sample analysis flow begins with performance checks, calibration, decane blank, samples (including QC), and calibration point at the end of the run.

Recommendations: No recommendations were made for this observation.

FIELD INSPECTION CHECKLIST

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STUDY PROTOCOL	POAPO PA/OC. Plan 6	05-AL22-93 AL4	13251
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Personnel Involved	Tiles Staff - Fred	/	
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Personnel Involved Ray Ranguaj Silis
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Personnel Involved Paul Well, L. H.	raise	
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•		_
11:40A 570A M2=9.1 9.8	1580A = 02 = 0.0 9,0 Chai	RII 9.
Sample collection, containers, custody and transfer	procedures NA Applicable	
		_
		-
		_
Additional Comments 7000		
,	÷	
		_
		_
Recommendations The Ralibration for	om was soulable in whi	ich
A record results & calibration	r. Leadouts must be	<u></u>
retained on trackable	data reverd from who	oh
FLDLST.05/93 Auditor's Signature and Day	dudy hadur 23-yaly 1993	

85 05 of 28

AUDITOR <u>JMA</u>			=	Jely 14		^
STUDY NUMBERS	99.902/4 SITE 1	LOCATION	Wiles S	ation,	mes, oki	Ó
	Process					
STUDY PROTOCO	LOAPP DE-A	122-93	PC 9551	1 /6 July	1993	
Field Phase Inspected	1 Oursen De	rdiette (Ligite.	Set 01)	Subcontraci	n
Personnel Involved _	Mark Hru	neback,	Chester	RTI	tapp	
Protocol/QAPP/SOP	Requirements and	d RTIL	etter 71	5 guly 194	3; p5.1-	3 5
Narrative Account	Figure #9.	Calibra	tion at	2X = 0.0	, <0.0	
RTI recon	amende uses	ig a Re	stifiel	Starle	ud to	
recheck Ly		<u></u>			<u> </u>	
	· · · · · · · · · · · · · · · · · · ·				·	
Sample collection, co	ntainers, custody an	d transfer pro	œdures	ret ans	slitable	
·						
Additional Comment	s abstitute	som BT.	[2. Fl	enge !	doing	
		filter a			, v	
an RTI	ku on 21 p	w aud	if Salu	tex	0	
						
Recommendations	Ahone i	n nau	ative			
FLDLST.05/93	Auditor's Signatu	ire and Date	indy M. C	Endewa .	23 July 199	3

Py 06 0 28

AUDITOR Smanderson DATE 20 July 1993; 213	ulij 1943
STUDY NUMBER 50130214 SITE LOCATION Mes Station, Miles Ohio	U
SNOT PLACES TIME 1225 P	
STUDY PROTOCOL QAPP) DE 40-22-93 PC 9325/ 16 gely 1993	
Field Phase Inspected Lample Persessing and Custady	
Personnel Involved <u>Velue Smith</u>	
Protocol/QAPP/SOP Requirements ON pg 5.1-25 % 29	
Narrative Account Ishels and custody forms company	-
dr 07/19 simpler; Chestu sampler sent to Bettelle	ş
for lotalian 20, 21, mum on 04/A, Chester relingue	alec
Custody & Ach Linter luko then sends spls. Is	·
Battelle with original chain of Custody from	
Sample collection, containers, custody and transfer procedures	-
(whome copied and promised to Chester Ougi	il
form will be received by Selenatory Lang	26
Custodian in Columbus. Tiale well supplied clabels.	ent form
Additional Comments Servewed Sampling Data sheets on	V
07/21/43. Some Lampling data sheets need to	
he seconded is completely and legibly as	
possible bassur translulity (Aldehyder, VOST, CN, acid &	Mac MA
Recommendations See above and note that Concetions Me	est.
not shliteiste sugnie entry Use single line-th	ill
pires contary	July 02
FLDLST.05/93 Auditor's Signature and Date Sharky Markey Bylly	143
Down notes 01/20. Tiller preper after recoping lite on o	4/1
Down notes 01/20. Filters presped after resource late on to how properly stored on drivill link not larged onto to custody form by hair belowing leader dissussed Al Salar and belo Smith 8-43	2
The Soler and Mile Smith B-43	728

AUDITOR Manderer	DATE 0/ July 1993
STUDY NUMBER 30302/4 SITE I	OCATION Miles Station, Miles, Phin
SACY PLANCE	TIME 740A day 03
STUDY PROTOCOLOAPPOA/OC	PLA DE-ACOD-931093251 07.16.93
Field Phase Inspected Buffoust	Inlet Sempling Location 18
Personnel Involved Paul Webh	Kent
Protocol/SAPP/SOP Requirements	P5.2-10
	Ter Calibration of location while
setting seale for he	atical traseise. Collecting
22 valid simpling p	truel traperse. Collecting unto on the peticial Points Lage. Lecond sample was
on people marked with	tape. Second sample was
setting up for house	
Sample collection, containers, custody an	d transfer procedures
Additional Comments Particul	late Tield Date forms- Seminded
•	
as possible legore	teanspeired these forms to the
Sanale oustodian	
Recommendations	
FLDLST.05/93 Auditor's Signatu	re and Date Surly Markern 23 July 1993

8 6 09 7 28

FIELD INSPECTION CHECKLIST
AUDITOR SMARLEUM DATE 22 galy 1493
STUDY NUMBER 54302/4 SITE LOCATION Mes Plation, Notes, Chic
Shoy PROCESS TIME 930A day 03
STUDY PROTOCOLIQAPP PANDA Plun DE-AC22 43/12/3251 07.16.93
Field Phase Inspected Bighouse Outlet Singling Socition 19
Personnel Involved Harry Leonard
Protocol/QAPP/SOP Requirements DN 5.2-17
Narrative Account Mutech Stuck Sampler under going a
Critical Drigice Check. Observed aldehyde
impinger teach being setup on lower platform.
heitied traverse probe already set up for first
sempling point Distances market on probe.
Sample collection, containers, custody and transfer procedures <u>In-Process</u>
sampling not get initiated
Additional Comments Herry Red discussion Crim Henry le Probe
temp > 250°+25 requirement in method in last two Sanulina
sinte Hangwill do a single sur à seouide san temp
neity no significant heat law.
Recommendations /Une
FLDLST.05/93 Auditor's Signature and Date James M. andum 29 July 1943

Pg 10 of 28

AUDITOR & Mardens	DATE 21 71/1995
STUDY NUMBER 303024 SITE L	OCATION Take Station, Miles Okio
Shox Risees	TIME 12 noon day 03
STUDY PROTOCOLOAPE DA/DO	Man DE ACD D-93PC 93251 07.16.9
Field Phase Inspected Jumma Can	uster George to Locations 18, 19
Personnel Involved Paul Webb,	Herry Georesal
Protocol OAPP SOP Requirements	APP P 5.2-39
Narrative Account <u>Summa</u> &	anisters were taken to base of
lack sampling platfor	cass-checked tag wakes
sample for eset. C	coss-checked tag wakes
on cannisters.	
Sample collection, containers, custody and	d transfer procedures <u>Extitle</u> Municipal
for These Summa les	risters & 88-044
· ·	89-005
	88-059
Additional Comments Wine	
Recommendations None	
Trooping	
ET DI CT 05/02 Adianda Cimatur	re and Dato ich Mandem 21 3 1993
FLDLST.05/93 Auditor's Signatur	ie and Dales and Allical Month of The Man a

Pg 11428

AUDITOR Manderson	DATE 21 guly 1493
STUDY NUMBER 30302/4 SITE LOCAT	MON Niles Station, Miles, Ohio
	TIME 1/30P day 03
STUDY PROTOCOLOAPP WA/WL Flan	DE ACD2-93PE 9328/ Duted 169
Field Phase Inspected Sulfuie Reis	L Sampling, Leation 22
Personnel Involved ABB Staff	
Protocol/QAPP/SOP Requirements OM	05.2-19
Narrative Account Observed SA task under SASX town into pueleaned and Constitute daily sample	mple ballection from
tish under SNOX town	a. Sangle rollected
into succeeded and	englass bottle. This
Constitute daily sample	in The process.
Sample collection, containers, custody and trans	sier procedures Nove
•	
Additional Comments None	
Additional Comments 70070	
Recommendations None	
FLDLST.05/93 Auditor's Signature and	Date Sindy M. anderson 23 gray 1443

B/12 14 28

	AUDITOR Landy M. anderson DATE 29 July 1993
	STUDY NUMBER 54302/4 SITE LOCATION Tiles Station, Miles, Ohio
	- Battelle Loom 6028 TIME 603P to 8P
	STUDY PROTOCOLIGARD PAIN PLAN DE AC 22-93PC 93 05/07.16.93
	Lab Phase Inspected Sample Levipl and Log-In
	Personnel Involved Sue Champagne, gan Satola
	Protocol/QAPP)SOP Requirements Off py 5.1-29-32
	Narrative Account Lamples pricklupin libbly at 603 Part transferred
	6 room 6028 (locked, included three Coolers and Denen bove
	SRB 46757 was used & welled receipt. Included Brite
	egle, MM5, MUM location SH. Chain & Custody from &
	samples reconciled by (Lue) you and Sue weigies
<u> ۱۲۲</u>	
O.	Sample storage, preparation, analysis and custody procedures Labels on hattles. Most
1	hottle cape are unlabelled Tracked NSA mom +27 spls.
	to ON ny 5.2-30 diagram- all epls. alemated pr.
<	07/28 NA MM5 Smurger perbe unas Cyclones
4	Additional Comments and PRA-13 # 9,10,13 Checked. All leage
	and hubble was protecting simple were Cuefully
	split weich a life knife. Fork out rever water sangles
	in quart amber tractiles as well as Coal Lun-off.
	Recommendations ONT pg 5.2-22 spllefier 4-liter Glass
	bettle for #9, 10 and 13 sample. Many a quait anher
-	feotles must be addressed Conta a 29 july 02
	LABLST.05/93 Auditor's Signature and Date 30 July 199 Sunky Mandeum
	D # 9 location called Live Trates on labels is
	reflered bas Makeup Menter, ON pg 5-2-22
	29 13 01 28

AUDITOR Landy M. ander DATE 29 gally 1993-02 Contr	<u>.</u>
STUDY NUMBER 519312/4 SITE LOCATION Tules Station, Niles Phile	
TIME	
STUDY PROTOCOL/QAPP	
Lab Phase Inspected	
Personnel Involved	
Protocol/QAPP/SOP Requirements	
Narrative Account NA-MM5-0728 trap sample were immediately	h
transferred & Sever freeze (GI 93219) in Loom 6031	/
N.13. PRN. 0429 has single ently of "no pH adj. pH	
alienty (2"; fette spl. NAMMS 04.28 and fette	
MUM 5 A (and 5B) 0727 tracked to Cayl Home.	
Sample storage, preparation, analysis and custody procedures <u>Aldehydia</u> <u>NAHIDU</u> 728	7 /
40 Mamber Sap 1,2,3 (Red ID on like) transecred to	
minitared reflig (195283) in loom \$6028. NA mm5	
Letters 1 and 12 0728 ESP Inlet transpersed to present	
Additional Comments Low letter spla 9 and 10 for 0726 and	
0728 plus in regrigerator. All samples received at 67	
were peoplely transferred and stored. MUM and CN	
spla were transpersed a for 7028 rold (40°F) storinge	
ARccommendations facility while is locked bustody form	
originale are social by sample D, put into binder and	<u></u>
singer numbered consecutively. Original remain	
LABLST.05/93 Auditor's Signature and Daniel Minkey 30 July 1993	_
with bustodien, Copies go a analyst and lechnicis	in less
with bustodien, copies of to analyst and technicis pressing sple. Initial pH and temp relacted >5 st where required. All sample processing hegins 27 da bulling time. B-50 B-50 B-60 B-70 B-70 B-70 B-70 B-70	-r -w
Killing Time. B-50 Conta. 29 gr	leg 0.

AUDITOR Landing M. antern DATE 29 July 1443-03 Contid.
STUDY NUMBER 58930214 SITE LOCATION Miles Station Miles, Ohio
- Battelle Loom 6028 TIME 6-88
STUDY PROTOCOLUDAPIGA/OL Flan JE AC 22-93 PC 9325/87.16.93
Lab Phase Inspected Simple releigh Rustody transfer storing
Personnel Involved Sue Chingsgov, Jan Salila
Protocol/QAPP)SOP Requirements OAF pg 5.1-27, 28
Pleommentations from New its hattom of page:
1.13. PRI.0729 have four hottles link thenticel sample
ids. sequential samples must have sub-ID for treceability
@ PRI simple in AV me waterfor location 9 on 07/29 Race
identitel ID 5 pm 500 me andwhatther. Need to differentiate
SM Sample storage, preparation, analysis and custody procedures for the little and
araliza 6) Su lecommentation re qual, amber lettes
raite their AL ambu on pgo1; Blakel / Coje discuspancies
follow: N8 PRS 728 from Roppers read 1700 hrs on
8M Additional Comments label and 1600 hos on CyC; 6.07.28 air heater
ash from #3 is called "leonomou ash" on labelle
Spl 2-3 time 19:30 label 14:30 Cof C
2-4 lines 11:25 like 11:30 cby C
Recommendations 17:30 lake 1700 eg c
Coal sample No 1. PRS. 727 2 happy 07.27.93 Notine reloided
LABLST.05/93 Auditor's Signature and Date Link, Marketon 30 yelly 1993.
All of above issues were relayed to the Field Sampling manager by shore on 30 gilly 19 93 by the OAO.
manager by shore on Bozilly 1993. Uz CAC.
P515 728

AUDITOR Manderson		_ DATE <u>04 au</u>	quot 1993	
STUDY NUMBER SC4302	14 SITE LOCATION			
- Buttelle Loom		<u> </u>		
STUDY PROTOCOLOAPP	DE AC 22-43	Pe 93 251	07.16.93	
Lab Phase Inspected	Ol - Lequil.	Samples Ry	Trection	
Personnel Involved				
Protocol/QAPP)SOP Requirem	nents ONF 53-	17-18		
Narrative Account Method	#3510-Autr	action Metho	in Sepuato	ry
funces all labelle				V
One liter sample,	amber four	L hatter	heorghtup	-
from rold store	ge. OC sun	nes preprie	1: M3, M3	O (Ports)
Duplicate (Liver	mater), Hys	Elik		
Sample storage, preparation, a				.730
Pond water, Live	water, Sip,	blank, field	Blank to	
lrb and the	ain-p-Custo	dy forms		er e
Additional Comments and		// / -	· ,	Œ),
labelled e name, a	ste storage ten	up]; alked	1. aml Speke	ng
Standard (463 99-	77-20), add	melly, sh	ake Two	V
minutes. Naca				
Recommendations "Cha		^		
insafficient for	tiaceabiliti	1 Discuss	el earlier	
C Form Kelly. Ca. LABIST.05/93 Audito	the law safe	ety re upa	Ited hold M	miloring
LABLST.05/93 Audito	r's Signature and Date	ande Mande	on 05 llugue	119930

Pg 16 428

AUDITOR SMARLUM DATE 05 August 1493 STUDY NUMBER SUSONS SITE LOCATION TIME 10 A Personnel Involved Protocol/QAPP/SOP Requirements Sample storage, preparation, analysis and custody procedures LABLST.05/93 Auditor's Signature and Date date is retained the so output defuence. after spls, are hun, Vol Canisters are

	AUDITOR Marker DATE 05 dugust 1993
	STUDY NUMBER 524302/4 SITE LOCATION Tiles States, Rike, Ohio
	-> Battelle In 4333 TIME 130P , 325P
	STUDY PROTOCOLDAPP PA/NC Plan DE-ACQJ-9 3PC 9325/ Natel 16-94/193
	Lab Phase Inspected PAH/SVOC - Liquid Sangle Concentration
	Personnel Involved Sue Changagne
	Protocol/@APP SOP Requirements DAP Pg 5.3-17
	Narrative Account Concentrating samples (Kudune-Rinish) in
	Blue M Heated Water Bath; Mells artiset Combined acid/bas.
	Theremeter measures water temperature at 65°, 40°
	Concentrates is LIOM - GC will - analyst for storage
	and analysis at JN-4 facility (Battelle).
	Sample storage, preparation, analysis and custody procedures spl. 46707-09-04
	K-D flack + welever anyor labelled & Simple D. C-of-C
	sugisel form remains a semple enstadian. Samples
	are kept under locked custody.
	Additional Comments Micri Snegder Contentiation (1.0 ml ace
	transpersed to Wheaton Blass wals with tellon-faced
	silieon septa. Tuila au labelled and labels Conerd
_	with clear tape, teflor tape wrapped. Spls: lytrute
3/1	Recommendations stored in X42319 fleeger, Km 7245
	Tracked A6707.09.03 Pond Water
	N. 9. Pak: 731-05 Trip Blank 46707-24-10 Water Blunk
	LABLST.05/93 Auditor's Signature and Dato Sunky M Maleur 06 (linguest 1993)

Pg 180f 28

AUDITOR Mandern DATE 1/4	Ruguet 1993
STUDY NUMBER 56431014 SITE LOCATION Miles St	ton Riles Okio
-> Pm 7343 TIME 83	OA
STUDY PROTOCOLIOAPP) DE AC-22-93-PC 9325/	07.16.93
Lab Phase Inspected anion analysis - Son Chus	mato graphy
Personnel Involved Save hermillion	
Protocol/OAPP SOP Requirements ON 14.5.3-8, 9	5.1-16,17
Narrative Account Sangle Storage at 500 # 68	6-03/ VWR, Monitored
on workday; locked dewing off- beity	_
Week some as Performence Evaluations	
EBA - neijod by EBA - PE reporte A	ent by EPA 21/year:
INS precision standarde made from	
Sample storage, preparation, analysis and custody procedures Like	Hassignid by Reve,
cross reference to original chain of Custo	
resligtion. Dane releve spls. and C.o.	of copies and
also signs sugarel from. Laugh stat	tus Shoot selected regulace
Additional Comments Law Cata acquired - analy	gel-resortel.
Separate deplicates and Spike Shap.	D Standards
and Calibrations brop pgs. Buth star	have exp.
dates, bept 6 months. Phasplate m	ade up fresh for
SMARccommendations la latel. Blindly is Constitution	tions deserbe
column and eluents & Chionatogram	are finil output.
Tile sent for Ol Leview include	: Jenel amore Seport,
LABLST.05/93 Auditor's Signature and Date Man May 100 of	anderson Haugust 1993
Summary Report, Calibration Plats, &	Suplicate and Spike
Summany Report Calibration Plats, A.	qui Conditions,
Chiomatograms.	Contd. 11 Aug.02
B-55	1919728

AUDITOR IManderon	DATE // allfast 1993-02 Contr
STUDY NUMBER SELSO 2/4 SITE LOCAT	TON Miles Station Miles Chic
	TIME 10:10A
STUDY PROTOCOL/QAPP	
Lab Phase Inspected	
Personnel Involved	
Protocol/QAPP/SOP Requirements	
Narrative Account 40 amher will lan	bel excelled & sustably record after
remone from locked regin	g. Sal aliqued removed to
Dioner will. andlyt weeks	cones to heading of semples.
hinds marked & spl. ID as	al deletion of 4.95 me DI Har and
500 spl. C 54d Irleon aux	toxiqueta . Linu pipel c'house" @
Sample storage, preparation, analysis and custod	ly procedures PRL (Dioless Waters)
13 35-36, 1341-46 from 176	28; 1345: spl. duplicate,
and spike (0.2 pp gla	analyte); 13/00 spl delution
usid. again som	· <i>U</i>
Additional Comments Equipment! Sil	esa autopipette # C 480039,
Calib before talk use. Me	The AE160 # A61210 , like duc
09/99; Weight set 5/N 5386,	
Dionex 11/3790; Balence rela	ad looking Calibration Colord &
MRccommendations M Mutter, Also 14	sel as blink, plastie pipet
and plante arklemezus. DI	420 putints plasher fresh ea day
Sol dilutions performed die	ettly into Dione Mula Contil-03
	DatoSprdy M andeum 1/august 1993
(4) contd. and weight certific	exter. Pipetto Calibration- meighe
50,00 H20 into plastic lienkl	entes. Pipetto lalibitlión-meighe n meighto muci. 0.050, 0.051 and
0.00	Do 20 01 28

AUDITOR Mendern	DATE // august 1993-03 Contil
STUDY NUMBER 50 4302/4 SITE LOCATION	N Miles Station Riles Philo
	TIME
STUDY PROTOCOL/QAPP	•
Lab Phase Inspected	
Personnel Involved	
Protocol/QAPP/SOP Requirements DAP P	5.1-45
Narrative Account Letonday delation	4.5ml Hgo and 0.5mlg
1) from pg 02 this report. Was po	out a point ala. pipet po la
ones duplicate set and all sple	hoes estiluted Silson for 1:00
sel deletion- Sel vials are n	at mused before aliquothing
as analyst is locking for &	sluke miterials only.
Sample-storage, preparation, analysis and custody p	rocedures Stock anion stal used for
spile; spla. Cappel e Olp 1	suing huilf-in fette & mixel-
leses Sogiel Illeon autorizetto (le	skirated) for 420. Alls. stoll in
same repig as spls. 10 pl la	Dld spike usel for 30/1
Additional Comments total spike mi	
100 pam Fill and 804. Cape	tightered diluted & spiled
pple mixed. Irb pg2, 23 dec	
in holuminture Clasks made	
MRecommendations in study records.	
Just Want - refugicated was	te black - delivert blanks,
rense risals. Acquires dala	
j.	Sendy Minder 12 lugust 1993
made up Lanalyria state	Contil 1/ Aug. 04
Standards and Just Blank	lorded into autosampler.
Standards and Siist blank Andigst Rhelha Standards analy all elemente are < re limites	on as generaled in caree of
· U	v // 1

AUDITOR SMARKUM DATE 1/ August 1993-04 Contr
STUDY NUMBERS 19312/4 SITE LOCATION Miles Station Miles, Ohio
STUDY PROTOCOL/QAPP
Lab Phase Inspected
Personnel Involved
Protocol/QAPP/SOP Requirements
Narrative Account Loutine Maintenance often cell + Conduct cell.
Calib Std. 2x year or when anelyt determines need @ Collins
Change recorded Conductivity Cell Calibration Standard =
I mM KCl made up 1x year. Non soutine Minterance
recorded in logbook. Name has copy of Work Plen
Mample storago, preparation, analysis and custody procedures 2 PA NUCKU 300,0
December 1989, pgp 01-04 Sect Method for Detma of Inngaine
anions in heater by An Cheonatography- PESta WP029
from EDA EMSK-was rogul ing pelune. Method Calls for
Additional Comments 10 00 Bl polo Keltmonended & Dave that
spiking proces for matrix samples he performed. Wate
can be qualified in the analytical report is not reported,
saturatel, Ite. Peak Pro Hersion 2.1
Recommendations Add instrument ID speece to reloid lively
Date and initial Final anion Separt for traceilality
@ Attack (tape) believe electricates in logback
LABLST.05/93 Auditor's Signature and Date aut. M. Undur 12 August 1493
@ add regionne to use of EPA 300, Dec 1989, as guidelines
6) and huif description of sel greek to reload book.
PG 22 07 28

AUDITOR SMARLEW	DATE 20 august 1993
STUDY NUMBER \$302/4 SITE LOCATION	Titles Station, Miles, Olio
-> Bettelle Loon 6004	TIME <u>930A</u>
STUDY PROTOCOLOAPP DE-ACOS PSE	
Lab Phase Inspected PAH/SNOC Sha LAL .	
Personnel Involved <u>Rave Ravie</u> , gan	
Protocol/QAPP/SOP Requirements OAP 14	5,3-13 6 16
Narrative Account Chomatography: leave	· · · · · · · · · · · · · · · · · · ·
8 hr at 451°C-done greek battle	Ida and approximately
10 g weighed onli ea columns	; Glesewen Estern Coura 810
delute acid, muffled afterwar	
ellining Lilies gl columns he	a wet- pucked
Sample storage, preparation, analysis and custody pro	
(B)	07:30 tracked. Sample cole
ID wed as theff-requence.	Save Oyler esteate (ID #)
- Meri O Pare Kornis (New ID.	#) Chromapley Nices
Additional Comments Meege - monitoris	ng 18/week (SN97/623)
Krelininger study for fracts	ionation determined
resturned used and details	you solvente using
L scaliditet procedure.	Contil 20 aug 05
Recommendations Recommend Calebras	
losse battles into selondary &	ortainers to prevent
existe luckage padlocking	beege duing non-working
LABLST.05/93 Auditor's Signature and Dates	Sendy Mandem 23 august 1993
hours since laboratory is m	not locked.

8933428

AUDITOR & Marden	DATE 20 august 1993-02 Conta
STUDY NUMBERS 1902/4 SITE LOCA	TION Niles Station, Niles Shio
	TIME
STUDY PROTOCOL/QAPP	
Lab Phase Inspected	
Personnel Involved	
Protocol/QAPP/SOP Requirements	
Narrative Account Contentialin 1	uile stoppered lonere de
teflor tape, labellede serg	le D, lubt date 7 press,
temperature/storge - Se	lièa Column is labelled c
Sample site ID - piels la	belled & Ork and spl. ID.
Capo have texton lineus	and are muffled (8 his/4510) < lise.
Sample storage, preparation, analysis and custo	ody procedures Spl. loaded onto Whema
•	(Awash distacted ofthe packing
	la / aware - amber haller
labelled e lia, spl. D. to	gel of fraction. Willete fractions
Additional Comments Ree Stoud n	had at st. watel next step
(southery), sept. see. 760	10000 100 Nova 1011
Tules 53. F. 730 A, 54	,5B me spl. IDS Conta Tolling
Muffle oven - Bluem CN	7880F; 3/N CW 565; Nood X95526
, .	d las monitored 04/12/93 -
· · · · · · · · · · · · · · · · · · ·	netoring face relocity
in 6004 a delemine	
LABLST.05/93 Auditor's Signature and	d Dawsenly M anden 23 lugust 1993

Pg 24 0/28

AUDITOR Makeram	DATE 22 august 1993-03 Coxti
STUDY NUMBERS 14 312/4 SITE	LOCATION Niles Station Niles Phio
- Loom 6004, 6l	031 TIME 1/A, 20 august 1993
STUDY PROTOCOL/QAPP_	pals were intoted
Lab Phase Inspected	
Personnel Involved	
Protocol/QAPP/SOP Requirements	
Narrative Account Sangle Cont	rentation - New removes lakel from
anher bottle, transfe	us & XD set-up. 2-31 rinse C
nelly. and hailing a	hips. Turap mano-snyder e
Lod short uniec Me	els
Sample storage, preparation, analysis an	nd custody procedures Offlore Lample transf
from Rane Oyler / Mel	line Hayer to Dave Dave - downe
in A6688 for log-in the	in stored in frager until futtionate
initiated, transfer also	documente in D. Oylers prep bre
	Ed sample teanspered to Chromaples
_	internal standard Then reduced
C Na majoretor. Concent	tested Dem fullions first then MDH fin
Blue m water back 6:	
Recommendations all glasses	wex bailing Chips muffled;
recleaned and remuffl	ed afterna e clear glessivan on
	om lik 46688 p 42
	ture and Date Leady Mandeum 23 aug 1943

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AUDITOR SMANdeur DATE 1/October 1943
STUDY NUMBER 54312/4 SITE LOCATION Miles Station, Niles, Shio
- Battelle en 7249, 7228 TIME 210P
STUDY PROTOCOLOGAPP DE-AC22-93 PC93251 07.16.93
Lab Phase Inspected River Junan analysis GLIMS
Personnel Involved Mary Sarack
Protocol/QAPP/SOP Requirements ON P5.1-20,21
Narrative Account Spl. stored in fileger 5/1/386-024 (Em 7249)
MS Log 46575 P83 for ener VG analytical HY 5890 A Ge;
11-2505; Spo. removed from freezer, resitered linefly
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APPENDIX C SAMPLING PROTOCOL

SAMPLING PROTOCOL

C-1. Introduction

The purpose of this Appendix is to summarize important aspects of the field sampling effort at Niles Station that may not be adequately covered elsewhere. The actual schedules and sample recoveries achieved in the field are described in sections 1 through 3 of this report. This Appendix provides further detail on the procedures used in sampling, recovering, and storing samples from flue gas, solid, and liquid streams. This information is intended to supplement that provided in the QAPP for this project.

C-2. Reagent and Materials Preparation

The sampling conducted at Niles Station required a variety of chemical reagents and sampling materials, which were prepared or provided either by Battelle or by Battelle's subcontractors. All of the chemical reagents needed for flue gas sampling and sample treatment were prepared by Battelle, and distributed to Chester Environmental sampling personnel as needed. The purpose of this approach was to minimize sampling variance by using reagents from a single source. The list of reagents included acidified peroxide and permanganate for the Multi-Metals trains, carbonate/bicarbonate solution for the anion trains (Method 26A), 0.1 N H₂SO₄ for ammonia collection, 0.1 M NaOH for cyanide collection, and acidified 2,4-dinitrophenylhydrazine (DNPH) for aldehyde collection. These reagents were made up on-site from high purity starting materials, including deionized water, or were prepared from concentrated stock solutions brought from Battelle, when reagent stability made that approach appropriate. All reagent solutions were made up fresh on the day of sampling and distributed to Chester personnel.

Various rinse solutions were also brought to the site or made up by Battelle, for use in recovering samples from the various trains. Those brought to the site were deionized water, acetone, acetonitrile, and 50/50 methanol/methylene chloride. Rinse solutions made up at the site were 0.1 N HNO₃ and 8 N HCl. These solutions were supplied to Chester staff as needed.

Sampling materials were provided both by Battelle and by subcontractors. Materials provided by Battelle were Summa polished sampling canisters for VOC's, filters for all flue gas sampling runs except the HEST, and cleaned XAD resin for all SVOC sampling by Modified Method 5. The XAD was obtained and cleaned by Battelle, and was used to fill sampling glassware of different designs for Battelle and Chester. The filters provided by Battelle included 87 mm diameter for Battelle's flue gas sampling, 104 mm diameter for Chester's hot flue gas sampling, and 203 mm x 254 mm (8 in. x 10 in.) for Chester's PSDS sampling. All these filters were high purity quartz fiber. Filters used for SVOC sampling were muffled and stored in muffled aluminum foil before use. Filters used for Multi-Metals and particulate mass measurements were weighed under constant conditions before shipment to the field. Battelle also supplied pre-cleaned containers for most of the flue gas and solid/liquid samples.

Other sampling materials were supplied by subcontractors. Chester supplied precleaned VOST traps for use by both Chester and Battelle, and provided HEST carbon-impregnated filters and associated quartz particulate pre-filters for both groups. Chester provided cascade impactors and the necessary stage components for particle size determinations at Locations 5a and 5b. Zande Labs provided pre-cleaned 40-ml vials for headspace-free collection of liquid samples for VOC analysis.

C-3. Sample Preparation

The Battelle and Chester field sampling teams prepared their own respective sampling trains using the reagents and materials described above. Within each of the Battelle and Chester field teams, a single staff member was designated the Sample Recovery Leader. That person, and only that person, directed and approved the preparation and recovery of sampling trains. Each group used their own laboratory facilities on-site, as described below:

• Battelle's field laboratory is a 40-foot air conditioned semi-trailer equipped with a side entrance door and an electrically operated platform lift at the rear double doors. The trailer accepts 100 A of 125 V/250 V AC power by hardwiring to a transformer or switch box. This trailer served as the primary contact point for Battelle and Chester staff, and was used for meetings among project personnel to review the previous day's activities and plan for the current day. Such

meetings were especially necessary on the 6 sampling days, but were useful in the setup and shutdown phases of the field effort.

- Two 28-foot rental trucks equipped with side entrances were used by Battelle staff for preparation of flue gas sampling equipment and for recovery of some samples. The two trucks were equipped with tables, storage areas, and a desk for equipment setup, and sample recovery. One of these trucks was used as the sample recovery area for aldehyde samples only. This arrangement minimized contamination of aldehyde samples by acetone used in other activities.
- Chester Environmental's field laboratory was a laboratory trailer approximately 15 feet long, and equipped with lights, air conditioning, storage, and work areas. The laboratory trailer was used by Chester for preparation of sampling equipment, cleanup, sample recovery, and sample documentation tasks.

The facilities described above were positioned close to one another near the stack and the SNOX demonstration project at Niles Station. That location was roughly centrally located among the various flue gas and process sampling locations. In addition, two commercial compressed gas tube trailers were positioned near the base of the Boiler No. 2 stack. Those trailers were obtained by Chester, and supplied the N_2 and O_2 needed as diluent gas in the plume dilution sampling at the stack.

Written procedures for reagent and train preparation were provided to field staff, and were posted in the train preparation areas of the Field Facilities. Copies of those documents, which included sample recovery as well as preparation procedures, are included at the end of this Appendix. All sampling reagents and trains were prepared under the direction of the Sample Recovery Leader. Every flue gas sampling train was accompanied by a chain-of-custody form specific for that sample and sampling location, from the moment the train was assembled. That custody form remained with the train throughout sampling, and was returned to the field laboratory with the train once sampling was completed. That same form was then used during sample recovery and documentation procedures.

C-4. Sampling Methods

Table C-1 presents a summary of the chemicals measured, the type of samples in which each chemical was measured, and the sampling methods used for each.

TABLE C-1. SUMMARY OF REQUIRED MEASUREMENTS AND SAMPLING METHODS USED TO ACHIEVE THEM

Measurement	Type of Sample	Method
Volatile Organic Compounds (VOC)	Flue Gas	Summa Canisters(a)
	Flue Gas	Volatile Organic Sampling Train (VOST)
	Liquid	Process Sample Collection
Semivolatile Organic Compounds (SVOC)		
Polycyclic Aromatic Hydrocarbons (PAH)	Flue Gas (Vapor)	Method 23/Modified Method 5
and Other SVOC	Flue Gas (Particulate)	Method 23/Modified Method 5
	Solid	Process Sample Collection
	Liquid	Process Sample Collection
Polychlorinated Dibenzo-p-Dioxins and	Flue Gas (Vapor)	Method 23/Modified Method 5
Dibenzofurans (PCDD/PCDF)	Flue Gas (Particulate)	Method 23/Modified Method 5
Volatile Elements (Hg, As, Se)	Flue Gas (Vapor)	Hazardous Element Sampling Train (HEST)
Elements	Flue Gas (Particulate)	Method 29
	Flue Gas (Vapor)	Method 29
	Solid	Process Sample Collection
	Liquid	Process Sample Collection
Anions (F', Cl', PO ₄ ", SO ₄ ")	Solid	Process Sample Collection
	Liquid	Process Sample Collection
	Flue Gas (Particulate)	Method 26A/CARB 421
HCI, HF	Flue Gas (Vapor)	Method 26A/CARB 421
Ammonia	Flue Gas (Vapor)	Impingers, APHA 401
	Liquid	Process Sample Collection
Cyanide	Flue Gas (Vapor)	Impingers, APHA 808
•	Liquid	Process Sample Collection
Aldehydes	Flue Gas (Vapor)	TO-5, APHA 122
	Liquid	Process Sample Collection
Radionuclides	Solid	Process Sample Collection
	Flue Gas (Particle)	Filter from Ammonia/Cyanide Train

TABLE C-1. (Continued)

Measurement	Type of Sample Me	Method
Carbon	Solid	Process Sample Collection
	Flue Gas (Particle) Fill	Filter from Ammonia/Cyanide Train
Particle Size Distribution	Flue Gas (Particle) lmg	Impactors
	Flue Gas (Particle)	Cyclones with Method 29
	ESP Ash Pro	Process Sample Collection
Moisture, Heat Content, Ultimate/Proximate	Boiler Feed Coal	Process Sample Collection

(a) On Method 23 train.

The sampling methods used were detailed in the QAPP for this study. Brief descriptions of the sampling methods are as follows:

USEPA Method 29 (Draft June, 1992) - Multiple Metals. Method 29 is designed to determine emissions of metals from stationary sources. In Method 29, flue gas is withdrawn isokinetically from the source, with particulate emissions collected on a heated quartz filter and gaseous emissions collected in a series of chilled impingers. The series of impinger consists of two impingers containing a solution of dilute nitric acid and hydrogen peroxide, and two impingers containing a solution of dilute potassium permanganate and sulfuric acid.

A series of two glass cyclones preceded the pre-weighed quartz filter at the ESP inlet to provide size cuts of > 10 μ m, 5-10 μ m, and < 5 μ m in the collected particulate matter. These cyclones were located in the heated sampler box along with the particulate filter. Thus the 10 μ m and 5 μ m cyclones replaced the single 10 μ m cyclone normally used in the Method 5 type train.

Method 29 sampling at the ESP inlet was modified to include the use of a flexible, heated, Teflon sample line connecting the probe to the heated cyclones and filter. The flexible heated line, which allowed the vertical sampling required at that location, was made of 1/2 in. diameter, thick-walled, Teflon tubing and contained a temperature monitor. An empty impinger was used in the train for condensate drop-out.

USEPA Method 26A - Particulate Matter, Hydrogen Chloride, Hydrogen

Fluoride. Sampling was conducted along the general procedures of EPA Method 26A, with adaptations to the guidelines of California Air Resources Board (CARB) Method 421 in the collection solution employed. Method 26A is designed to determine particulate matter, and hydrogen halides in the absence of other chloride-containing volatile species. It is suitable for combustion sources where the primary source of chloride is the dissociation of chlorinated organic compounds. In the present study this method was be used to determine HF/HCl and their corresponding particulate anions, as well as particulate SO_4 and PO_4 .

A sample of flue gas is withdrawn isokinetically from the source, with particulate emissions collected on a heated filter and gaseous emissions collected in a series of chilled impingers containing a solution of sodium carbonate (1.8 mM) and sodium bicarbonate (1.7 mM). The method was used in this study in a single-point, nontraversing mode. The use of carbonate/bicarbonate solution as the collecting medium for HCl and HF followed the guidelines of CARB 421. The solution was prepared by a 1:1000 dilution of stock solution in the field. The same solution was used for rinsing of the probe and filter holder after sample collection. An empty impinger was used at the front of the chilled impinger train to collect condensed water from the stream. The collected condensate was saved as a sample fraction for chemical analysis.

<u>USEPA Method 23 - Semivolatile Organic Compounds</u>. Method 23 is designed to determine specifically dioxins and furans. In this study, Method 23 was adapted, according to Modified Method 5 guidelines, to measure polycyclic aromatic hydrocarbons (PAH). Thus Method 23 as referred to in this document is a modified method for measurement of the following types of chemicals, which collectively are called semi-volatile organic compounds (SVOC):

- Polycyclic Aromatic Hydrocarbons (PAH)
- Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans (dioxins/furans).

In addition, whole air samples were collected from the Method 23 train in SUMMA polished canisters, to determine volatile organic compounds (VOC). Samples for VOC were taken with both SUMMA canisters and VOST (volatile organics sampling train) for comparison of the two methods.

Glass cyclones were used in the Method 23 train as described above for the Multi-Metals train. At the ESP inlets the method employed a flexible heated Teflon sample line connecting the probe to the heated filter. The flexible heated line, which allowed the vertical sampling required at this location, was made of 1/2 in., thick-walled, Teflon tubing and contained a temperature monitor.

The SUMMA samples were taken directly into evacuated stainless steel canisters.

The samples were taken from a tee in the Method 23 train between the condenser and the XAD-2 cartridge for the Chester samples, and were taken from a tee upstream of the integral

condenser/XAD unit in the Battelle train. Each canister was equipped with a manual valve to maintain vacuum until sampling is initiated. A flow orifice was sized and installed in the sampling line (Teflon) between the tee and the canister valve, to provide a time integrated sample. The orifice was sized to allow the canister to fill over a one-half hour period. The Chester tee fitting was designed so that water condensing in the main air flow to the XAD-2 cartridge was separated by gravity from the small air flow (approximately 200 cm³/min) flowing to the canister. This arrangement prevented water from clogging the flow orifice in the canister line. In the Battelle train, a glass midget impinger containing hydrogen peroxide solution was placed in an ice bath, and served to condense out moisture and remove SO₂ in the flow line upstream of the orifice. Each canister connection had a compound pressure/vacuum gauge attached. This gauge was used to measure the initial canister vacuum, monitor canister pressure during sampling, and record the final canister pressure after sampling. Three canister samples were taken (approximately simultaneously with three VOST samples) on each organic sampling day.

VOST. VOST samples for volatile organic analysis were taken with a Graseby-Nutech 280 Volatile Organics Sampling Train (VOST), or equivalent. Sampling was conducted consistent with the procedures of SW-846 Method 0030 which provides for the collection of volatile organic compounds by adsorption onto Tenax and Tenax/charcoal sorbents, and with the guidelines stated in the VOST manual (Graseby-Nutech, Durham, NC). The standard VOST consists of a glass-lined probe followed by an isolation valve, a water-cooled glass condenser, a sorbent cartridge containing Tenax (1.6 g), an empty impinger for condensate removal, a second water-cooled glass condenser, a second sorbent cartridge containing Tenax and petroleum-based charcoal (3:1 by volume; approximately 1 g of each), a silica gel drying tube, a calibrated rotameter, a sampling pump, and a dry gas meter. The gas pressure during sampling and for leak-checking was monitored by pressure gauges which are in line and downstream of the silica gel drying tube. In this study, the Tenax/charcoal sorbent traps were augmented with a combination of modern carbon-based sorbent materials (Carbosieve, Supelco, Inc.). This approach enhanced collection and recovery of a variety of volatile organics from the flue gas streams.

Each VOST run consisted of three samples, each of which comprised a pair of traps in the VOST system. The three samples were taken over periods of 5, 10, and 30 minutes, at a flow rate of 0.5 L/min. Each VOST sample was run during the same time period as the SUMMA canister samples collected from the Method 23 train.

Impinger Sampling. Sampling for gaseous aldehydes, cyanide, and ammonia was conducted using a series of impingers downstream of a Method 26A type train operating at a single point (i.e., nontraversing) in the flue gas flow. The front half of the train consisted of a glass nozzle, glass heated probe, and a heated quartz fiber filter. The back half of the train was a separate set of impingers prepared for each of the analytes listed above, and changed out sequentially over the course of each sampling day at intervals corresponding to the appropriate sampling times.

The aldehyde samples were taken after the general provisions of EPA Methods 0011 and TO-5 and APHA Method 122 (Aldehydes in Ambient Air and Source Emissions). The sample were collected nonisokinetically, and the filter was not analyzed for aldehydes. The first impinger was an empty condensate collector, and the next two impingers contained an acidic 2,4-dinitrophenylhydrazine (DNPH) solution in which aldehydes in the sample are converted to form stable DNPH derivatives. These were followed by a silica gel impinger and a pump and metering box. The aldehyde samples were run for 1 hour at a flow rate of 1.0 L/min.

The sampling train used for ammonia and cyanide contained a filter to collect material for radionuclide and residual carbon analysis. Sampling was isokinetic at a single point. The cyanide samples were taken after the general provisions of APHA Method 808 (Determination of Cyanide in Air) with an impinger train, as those described above, but containing a dilute sodium hydroxide solution to collect gaseous cyanide and retain it in ionic form. The sampling time was about 1 hour.

The ammonia sample was also taken with an impinger train after the provisions of APHA Method 401. The train was similar to those described above, but contained a dilute sulfuric acid solution. Ammonia in the sample gas is converted and retained in the impinger solution as ammonium sulfate. The sampling time was about one-half hour.

The need for analysis of the filter in Method 26A for F and Cl dictated a large sample flow for that method. Replacing impingers for HF and HCl with those for ammonia, and cyanide readily adapted Method 26A to sampling those constituents as well, but required use of standard glassware and reagent volumes. Consequently, sampling for gaseous ammonia and cyanide employed full-size Method 5 glassware, with sample flow rates of 10-15 L/min. A single particulate filter was used throughout the sampling of ammonia and cyanide in sequence, to maximize the particulate sample collected for radionuclide and residual carbon analysis.

HEST. The Hazardous Element Sampling Train (HEST) was used to determine volatile elements at the flue gas sampling locations. The HEST sampler consists of a filter pack with a stainless steel support screen, and three 47-mm filters. The air flow entering the HEST sampler first encountered a quartz filter for particle collection, followed by two charcoal impregnated filters for collection of volatile elements (arsenic, mercury, selenium). The first impregnated filter is for collection of the volatile elements, and the second allows checking for breakthrough. Because only volatile elements are of interest, the HEST was used for nonisokinetic, single point sampling.

Particle Size Determination. Pilat Mark III Source Test cascade impactors were used to determine particle size distributions in both hot and dilute sampling at the ESP outlet, i.e., at Locations 5a and 5b in the stack. The impactors had an inlet, seven impactor stages, and a back-up filter. All impaction stages and the filter were glass fiber mat. The impactor performs aerodynamic sizing by routing the sample through a series of bends of increasing sharpness and jets of diminishing diameter. As the gas passes through the impactor jets, aerosol particles, which due to inertia cannot follow the gas flow stream, land on glass fiber filters attached to back-up plates. The smaller particles remain in the gas stream, continuing on to the next stage. With each successive stage, the mean diameter of the particles decreases down to the final back-up filter, which screens out all remaining particulate. The actual aerodynamic cut size per stage depends on the velocities of the gas through the impactor.

Cascade impactors were used at the ESP outlet at Niles Boiler No. 2, in both hot and dilute sampling modes.

A summary of the testing methodology follows:

- 1. Isokinetic sampling rates, nozzle size and sampling times were calculated based on preliminary velocity, temperature and moisture characteristics.
- 2. The units were assembled and sealed in a clean area, transported to the sampling location, attached to the sampling probe and train, and tested for leakage at 15 in. Hg vacuum.
- 3. The sampling head was then pointed downstream for a minimum of 10 minutes, to allow the assembly to warm to stack temperature. The assembly was then turned 180 degrees to begin sampling. The sampling consisted of a single point sample, collected isokinetically at a point of average flue velocity.
- 4. After the sample was collected, the sampling head was removed from the stack, disconnected from the sampling probe, sealed and transported to a clean area for disassembly and sample recovery. Collection plate filters were removed stage by stage using tweezers and placed in separate, labelled petri dishes. The jet stages were examined and any blocked jets cleaned.
- 5. The petri dishes were sealed for transport to Chester's laboratory for gravimetric determinations. The sampling head was then reassembled for the next test.

Hot Versus Dilute Sampling. Sampling was conducted at the ESP outlet (Boiler No. 2 stack) on both hot and diluted stack gases. Although the methods described above were used in both modes of sampling, substantial differences exist in the way the sampling was carried out. The following is a description of those sampling efforts.

The <u>hot</u> stack sampling was conducted using the four 3-in. ports arranged at 90 degree intervals around the circumference of the stack. Methods 29, 23, and 26A sampling were conducted isokinetically with traversing of stack diameters conducted for Methods 29 and 23.

Other gas sampling methods (HEST, VOST, aldehydes) were operated in nonisokinetic, single-point mode at the hot stack locations, since only volatile constituents are of interest.

All of the <u>dilute</u> gas samples at the ESP outlet were taken with Chester's plume simulating dilution sampler (PSDS). The flue gas sample was removed from the stack

through a single port, without traversing (traversing is prohibited by the size and configuration of the PSDS and peripherals). After dilution, mixing and retention, particle samples were collected onto an 8 x 10 in. quartz filter for various chemical analyses, and into a cascade impactor for size distribution by mass. Gas phase samples were taken from a common gas sampling manifold following the 8 x 10 in. particle filtration.

The major components of the PSDS are the inlet nozzle, transfer tube, mixing and aging (dilution) chamber, and the various particle and gas phase sampling apparatus. All of the wetted surfaces in the sampler are stainless steel, Teflon, or Viton.

A conventional Method 5 buttonhook sampling nozzle was installed on the transfer tube to extract a hot flue gas sample isokinetically. The nozzle was sized on-site to match sample flow with stack gas velocity within the targeted range of diluent gas rate ($\sim 20-25$ scfm) and dilution ratio ($\sim 25-35:1$).

The sample entering the inlet nozzle passed through the transfer tube and the dilution chamber for dilution, aging, and collection, along with secondary particles formed in the dilution process. The transfer tube was maintained at stack temperature to prevent premature condensation. An S-type pitot tube and a thermocouple were installed on the transfer tube to monitor stack gas velocity and temperature. The flow rate through the transfer tube was established by the difference between the total stack pressure at the inlet nozzle and the static pressure in the dilution chamber. This pressure difference, monitored with a Magnehelic gauge installed between the upstream port of the pitot and the dilution chamber, is referred to as chamber pressure. The chamber pressure-flow relationship is established by calibration of the nozzle/transfer tube assembly as an integrated unit. The operating chamber pressure was determined on-site using this calibration with the appropriate temperature and pressure corrections for the actual stack conditions encountered.

The dilution chamber facilitates mixing of the flue gas with dilution gas, cooling, and aging of this mixture to simulate the dilution processes occurring in a plume, and distribution of the aged mixture to the various sampling devices. The chamber sections can be configured to affect variety of dilution, aging, and sampling schemes. The chamber flows were balanced by throttling the dilution gas (supplied under pressure) as required to establish the operating chamber pressure (for the specified flue gas flow rate through the transfer tube) while maintaining the necessary sampling device flow rates (withdrawn under vacuum).

The dilute gas conditions result from the mixing of the flue gas with the dilution gas, at a dilution ratio of 25:1 or more. Accordingly, the composition of the dilution gas is of controlling significance. The purpose of the dilution gas is to simulate atmospheric plume cooling and condensation, while minimizing artifact formation and without adding background contamination.

The targeted dilute sample gas conditions were near ambient temperatures and <30 percent relative humidity (RH), after 2 seconds residence time. These conditions were considered appropriate to provide adequate condensation and equilibration of analyte species and to minimize artifact formation due to acidic condensate on sample substrates. The residence time was achieved by configuring the dilution chamber. In order to achieve the temperature and relative humidity objectives, the dilution gas was delivered at ambient temperature and virtually bone dry, i.e., less than 5 ppm.

A cryogenically pure mixture of 20 percent oxygen/80 percent nitrogen (by volume) was used for the dilution gas. Because both component gases were of cryogenic origin, maximum dryness and organic background purity were achieved. The dilution gas was delivered pre-mixed to the test site in high volume (40,000 scf) compressed gas tube-trailers. A delivery manifold on the trailers provided pressure regulation (50-60 psig) and activated carbon filtration of the gas prior to delivery to the sampling location. The gas was delivered to the sampling location through a Teflon line to a control manifold connected to the inlet of the dilution chamber. The control manifold consists of a rate control valve, temperature and pressure instrumentation, and final HEPA filtration.

The dilution sampler was operated according to Chester's PSDS Standard Operating Procedure, as modified to accommodate the special requirements of this project. This document provided the calibration, calculation, and operating procedures to establish and maintain the required balance of sample and dilution flows. The appropriate operating points were established on-site, using a calculation spreadsheet and a portable computer. The spreadsheet contained calibration constants for all of the appropriate dilution sampler components (transfer tube/nozzle combinations, flow metering orifice) and accepted operator inputs for actual ambient, stack, and sampling parameters. At start-up, initial operating points were calculated using estimated default inputs. Over the course of each test, the spreadsheet was updated with actual operating conditions and the appropriate operating points

maintained. The operating parameters were manually recorded at 15-minute intervals on special field data sheets which were designed for this project.

<u>Particle Sampling</u>. Dilute particle samples were collected with an 8 x 10 in. highpurity quartz fiber filter and with a seven-stage source cascade impactor from two parallel circuits exiting the dilution chamber.

Because of the low concentrations after dilution (<1 mg/dscm), particulate samples were collected for as long as the dilution sampler operated on any given sampling day. This was typically 8-10 hours, as required to complete the daily sampling schedules. Because of the combination of low concentration and low flow rate, the cascade impactor was operated for 2 consecutive days without changing substrates. This provided for three runs of 16 to 20-hour duration.

Gas Phase Sampling. All of the dilute gas phase samples were taken from a common gas sampling manifold installed downstream of the 8 x 10 in. filter between the metering orifice and the blower. Samples were taken for the same analyses as for the hot gas phase samples, with apparatus of essentially the same description. but using only the back-half of the respective train. The dilute sampling rates were higher than the hot sampling rates, to maximize the volumes of stack gas available within comparable simultaneous sampling times. Full-size impingers and metering systems were used.

Process Stream Sampling. Process samples were collected by grab sampling from the various process locations using appropriate collection methods and containers. Since some of the solid process samples were collected hot, the safety of the personnel collecting samples was of primary importance. Battelle staff called upon Niles staff for assistance as needed in any instance where safety was a concern.

Coal samples were collected by Niles staff and composited on-site by ASTM methods. Pre-cleaned containers of appropriate sizes and materials were used by Battelle staff for collection of other solid samples (ESP ash, air heater ash).

Bottom ash samples were collected manually by grab sampling using a cleaned scoop. The collected samples were allowed to cool in stainless steel containers before being placed into glass containers.

Collection of liquid process samples differed from that of solid samples in that multiple samples of different sizes were collected in different containers for different purposes. Aliquots of each liquid sample were collected directly into 40 mL glass vials without headspace, for subsequent VOC analysis. In addition, separate glass bottles were used to collect aliquots for elements, ammonia, and cyanide. Each of these aliquots was treated appropriately for sample preservation, e.g., reduction of pH to < 2 to preserve NH₃ for analysis. Finally, a large (=4 L) aliquot was collected in a glass bottle for SVOC and anion analyses.

C-5. Sample Storage and Recovery Procedures

Flue gas sampling trains were returned to the field laboratories after sampling for sample recovery by the Sample Recovery Leader. Sample recovery areas were off-limits to all but those staff involved in the actual preparation, recovery, and documentation of samples. Sample recovery was generally done after the completion of all sampling for the day, and after sampling staff had left the site. This further minimized interference in the sample recovery process. Sample recovery procedures were set out in single-sheet protocol forms, that detailed the train preparation and sample recovery steps for each train. These forms were distributed to sampling staff and were posted at each sample recovery area in the field laboratories. Copies of those forms are included at the end of this Appendix.

Samples recovered typically involved several portions or fractions of various types, or intended for various purposes. Samples were preserved and stored under conditions appropriate for the sample type. Table C-2 summarizes the preservation and storage conditions for various samples. Sample preservation consisted of adjustment of pH for liquid or impinger samples. Most samples were refrigerated in the Battelle field facility (4 C), or were stored at room temperature in shipping boxes ready for transfer to the analytical laboratory. The Modified Method 5 (Method 23) particulate filters were stored on dry ice in the field to maintain the -78 C temperature indicated.

TABLE C-2. PRESERVATION AND STORAGE REQUIREMENTS

		Preservation	Storage	Holding
Sample	Analysis ^(a)	Requirements	Conditions	Time
Bulk Solid Samples	Elements, F-C-P	None	Room Temperature	30 days
-	svoc	None	Room Temperature	30 days
	U/P, RAD	None	Room Temperature	30 days
Liquid Samples	Dissolved trace elements	HNO ₃ to pH <2	Room Temperature	30 days
1	Total trace elements	HNO ₃ to pH <2	Room Temperature	30 days
	Anions	None	4°C	14 days ^(c,d)
	voc	No headspace	4°C	14 days(c)
	svoc	None	4°C	14 days(b,c)
	CN	NaOH to pH >12	4°C	14 days
	NH₄	H ₂ SO ₄ to pH <2	4°C	14 days
Method 29 Train				
Impinger Solutions	Trace Elements	HNO ₃ to pH <2	4°C	30 days
Particulate Filter	Trace Elements	None	Room Temperature	30 days
Method 23 Train			 	
XAD-2 Resin	SVOC, PCDD/PCDF	None	4°C	28 days
Particulate Filter	SVOC, PCDD/PCDF	None	-78°C	28 days
1				,-
Summa Canister	voc	None	Room Temperture	2 days(c)
Aldehyde Impinger Train	Aldehydes	None	4°C	28 days
HEST Samples	Hg, As, Sc	None	4°C	6 months
Ammonia Train Impinger	Ammonia	None	4°C	14 days
Solutions, Liquids]	}	·
CN Train Impinger	CN	None	4°C	28 days
Solutions				
Method 26A Train	HF, HCl	None	4°C	28 days
Impinger Solutions			1	·
Method 26A Train Filter	SO ₄ =, PO ₄ =, F, Cl	1		
VOST Cartridges	voc	None	4°C	14 days

⁽a) F-C-P = Fluoride, Chloride, Phosphate

SVOC = Semi-volatile Organics

VOC = Volatile Organics

RAD = Radionuclides

PCDD/PCDF = Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo furan.

UP = Ultimate/proximate coal analyses.

C = Carbon.

CN = Cyanide.

NH₄ = Ammonia.

- (b) Extracted within 14 days, analysis within 40 days of extraction.
- (c) Samples were returned to Battelle within 24 hours after collection in the field.
- (d) Liquid samples were analyzed as soon as possible for phosphate to minimize degradation of this analyte in these samples.

Although as Table C-2 indicates holding times for the collected samples were quite long, in practice some samples were returned to the analytical laboratories immediately after collection by daily express shipment from the plant site. Those samples included liquid samples for anions, VOC, and SVOC, Summa canisters, VOST cartridges, and (when space was available) impinger samples from flue gas trains. Other samples were returned to Battelle with the field facilities at the end of the study. Chain-of-custody forms accompanied all samples at all times during storage on-site at Niles, and during shipment. A Battelle staff member was designated to serve as Chain-of-Custody officer at Battelle for samples sent back or brought back from the field study. That staff member had complete control over access to samples at Battelle, and distributed samples to the appropriate analytical staff only after cross-checking of chain-of-custody forms.

C-6. Sampling OA/OC

Quality assurance activities in field sampling included collecting samples of all reagent and rinse solutions, including deionized water, for use as reagent blanks. Method blanks were also collected, by preparing a complete sampling train, exposing it to the normal handling and transport procedures used before and after sampling, and recovering the train without sampling of flue gas. This procedure exposes the train to potential sources of background contamination as in normal sampling. In addition, specific QC procedures specific to each of the sampling methods were used. Those specific procedures are described briefly below:

OC Checks for Velocity/Volumetric Flowrate Determination. Prior to flue gas sampling, volumetric gas flow rate data were collected at the flue gas sampling locations, using the procedures specified in EPA Method 2. Quality control procedures were as follows:

- Visually inspect the S-type pitot tube or standard pitot tube before and after sampling.
- Leak-check both legs of the pitot tube before and after sampling.

- Check the number and location of the sampling traverse points before taking measurements.
- Clean and check inlet tubes periodically and clear ash from impact side of pitot tube as necessary.

Quality Control Procedures for Moisture Determination. The moisture content of the gas streams was determined using the technique specified in EPA Method 4. However, the actual moisture sampling was conducted as part of Methods 23, Method 5, and Method 29 sampling procedures at the flue gas locations. The following internal QC checks were performed as part of the moisture determinations:

- The volume of impinger contents was measured by weighing to the nearest gram before and after sampling.
- The sampling train (including impingers) was leak-checked before and after each run.
- Ice was maintained in the ice bath throughout each run.
- The volume of water in the collection bottle, into which water from the first impinger was periodically drained, was measured by weighing to the nearest gram.

<u>Quality Control Procedures for Flue Gas Sampling Methods</u>. The following pretest QC checks were conducted for all flue gas sampling methods:

- All sampling equipment was thoroughly checked to ensure clean and operable components.
- Equipment was inspected for possible damage from shipment.
- The oil manometer or Magnehelic gauge used to measure pressure across the pitot tube was levelled and zeroed.
- The pitot tubes and connecting tubing were leak checked
- The temperature measurement system was visually checked for damage and operability by measuring the ambient temperature prior to each traverse.

In addition to the general QC procedures listed above, QC procedures specific to each sampling method were also incorporated into the sampling scheme. These method-specific procedures are discussed below.

Quality Control Procedures for Method 29. EPA Method 29 was used to sample for vapor phase and particulate elements. The following quality control procedures were followed:

Prior to Start of All Testing

- The trains were assembled in an environment free from uncontrolled dust.
- Each sampling train was visually inspected for proper assembly.
- All cleaned glassware was kept closed with tightly closed ground glass caps or Teflon tape.
- All filters were stored in a precleaned glass petri dish sealed with Teflon tape.
- Pretest calculations were performed to determine the proper sampling nozzle size.

Prior to Testing Each Day

- The number and location of the sampling points were checked before taking measurements.
- The sampling nozzle was visually inspected.
- Each leg of the pitot tube was leak-checked.
- The entire sampling train was leak-checked.

During Testing Each Day

• The roll and pitch axis of the pitot and the sampling nozzle were properly maintained.

- The train was leak-checked before and after a run, if the train was opened for any reason, and if a filter change took place.
- Additional leak-checks were conducted if a leak exceeded 4 percent of the sampling rate, and efforts were made to improve the leak tightness of the train.
- The filter was maintained at the proper temperature.
- Ice was kept in the ice bath at all times.
- Proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum were made during sampling at each traverse point. Copies of the field operator data sheets are shown in Appendix D.
- Isokinetic sampling was maintained within about 15 percent.
- Sample train and field blanks were collected for analysis and maintained at approximately 4°C.

After Testing Each Day

- The final meter reading was recorded.
- Completeness of the data sheet was checked.
- A final leak-check of the sampling train was done at the maximum vacuum observed during the test.
- Each leg of pitot tubes was leak-checked.
- Recovered train following prescribed procedures.

Quality Control Procedures for Method 23 (Modified Method 5, with Summa Canisters).

Prior to Start of All Testing

 The Method 23 trains were assembled in an environment free from uncontrolled dust.

- Each sampling train was visually inspected for proper assembly.
- All quartz filters to be used were muffled and cleaned XAD was prepared.
- Openings of all cleaned glassware and prepared sorbent traps were closed with ground glass caps or precleaned foil until train assembly.
- All filters were stored in a precleaned glass petri dish sealed with Teflon tape, and enclosed in aluminum foil.
- Pretest calculations were done to determine the proper sampling nozzle size.

Prior to Testing Each Day

- The number and location of the sampling points were checked before taking measurements.
- The sampling nozzle was visually inspected.
- Each leg of the pitot tube was leak-checked.
- The entire sampling train was leak-checked.
- The Summa canisters were checked for proper vacuum.

During Testing Each Day

- The roll and pitch axis of the pitot and the sampling nozzle were properly maintained.
- The train was leak-checked before and after the run, if the train was opened, and if a filter change took place.
- Additional leak-checks were conducted if the leak exceeded 4
 percent of the sampling rate, and steps were taken to improve the
 leak tightness of the train.
- The filter and sorbent trap were maintained at the proper temperatures.
- Ice was kept in the ice bath at all times.

- Proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum were made during sampling at each traverse point. Copies of the field data sheets are included in Appendix D.
- Isokinetic sampling was maintained within 15 percent.
- Sample train and field blanks were collected for PAH and dioxin/furan.
- Canister pressure was monitored by means of a pressure gauge throughout filling of the canister.

After Testing Each Day

- Final meter reading was recorded.
- Completeness of data sheet was checked.
- Final leak-check of sampling train at maximum vacuum during test was done.
- Final canister pressure was recorded, and the canister tightly closed.
- Each leg of pitot tubes was leak-checked.
- The probe rinses and remaining train were recovered following prescribed procedures.
- Nozzle and cap were reattached for next day and the train was stored in a dry, safe place.

Quality Control Procedures for Method 26A (Impinger Sampling Methods (Cyanide, Acid Gases, Aldehydes, Ammonia). Impinger-based sampling procedures were used for sampling aldehydes and inorganic compounds. These methods were conducted at single points in the flue gas stream, isokinetically except for the aldehyde sampling. The following general quality control procedures applicable to all these methods were followed:

Prior to Start of All Testing

- The trains were assembled in an environment free from uncontrolled dust.
- Each sampling train was visually inspected for proper assembly.

Prior to Testing Each Day

- Fresh impinger and rinse solutions were prepared.
- The sampling nozzle was visually inspected.
- The entire sampling train was leak-checked.

During Testing Each Day

- The filter was maintained at the proper temperature.
- Ice was maintained in the ice bath at all times.
- Proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum during sampling at each traverse point were made. Sampling data sheets for these methods are included in Appendix D.
- Sample train and field blanks were collected for analysis.

After Testing Each Day

- Final readings were recorded.
- Completeness of data sheet was checked.
- Final leak-check of sampling train at maximum vacuum during test was done.
- Impinger solutions and rinses were recovered according to prescribed procedures.

Quality Control Procedures for VOST. Sampling for volatile organics was conducted using a Volatile Organic Sampling Train (VOST). The following are key quality control procedures followed in the field:

Prior to Start of All Testing

- VOST glassware was cleaned and assembled.
- The entire unit was assembled, visually inspected, leak tested, and its operation was checked.
- All VOST traps were cleaned, sealed, and labelled.

Prior to Testing Each Day

- VOST sorbent traps were kept sealed and stored in a refrigerator at 4°C.
- The VOST unit was assembled, minimizing the amount of time that the sorbent trap was open to air.
- A visual inspection was made and a leak test was made.

During Testing

- Flow rate was monitored.
- Operation of probe heater was monitored.
- Flow of ice water to condenser was maintained.
- Sampling time was watched closely, so the sampling interval was not overrun.

After Testing

- Final leak-check was performed.
- Sorbent traps were sealed immediately upon disassembly of the unit, and stored at 4°C until shipment for analysis.
- The VOST was prepared for its next use.

Ouality Control Procedures for HEST Sampler. Volatile elements in flue gas were determined by means of a HEST sampler, that used carbon impregnated (CI) filters for collection of the metals. Field QC procedures for the HEST were as follows:

Prior to All Testing

- Lab ID numbers were recorded on the petri dishes in which the quartz and carbon impregnated (CI) filters are supplied.
- A clean table area for loading of the HEST filters was prepared.

Prior to Testing Each Day

- The positions of the one quartz and two CI filters in series were recorded as
 they were loaded, and recorded on the sample data sheet with the corresponding
 lab ID numbers.
- Both sides of each filter were examined to assure the proper side faced the air flow.
- Teflon-coated tweezers were used in loading the filters.
- The HEST filter assembly was visually inspected during and after assembly.
- Both ends of the assembly were sealed, and the entire assembly was then sealed in a clean plastic bag.

During Testing

- The system was leak tested after attachment of the HEST assembly to the probe.
- Condensate was not allowed to backwash into the HEST assembly.
- When inserting the HEST into the duct, care was taken to avoid scraping the head on the port.
- A proper seal was confirmed between the probe and port.
- Flow rate, sample time, and normal Method 5 sampling parameters were recorded.

After Testing

- When the assembly was removed from the duct, care was taken to avoid scraping the head on the port.
- Final leak test was performed.
- The HEST was kept vertical while the system was disassembled.
- The HEST was sealed, allowed to cool, and the entire assembly was then sealed into a plastic bag.
- Filters were kept flat with deposit side up while disassembling the HEST.
- Filters were placed flat with deposit side up in labelled petri dishes.
- Petri dishes were stored flat.
- Probe and filter chamber were rinsed with acetone and 0.1N HNO₃, and combined washes in a labelled sample jar.

Quality Control Procedures for Particle Size Distributions. At designated sampling locations, particle size distributions in flue gas were determined by cyclone or impactor sampling. The cyclones were incorporated in the Method 29 and Method 23 trains covered above, and used at Location 4. The following are QC procedures applicable to impactor sampling, which was conducted at Locations 5a and 5b.

Prior to Start of All Testing

- All impactor stage filters were preweighed.
- The impactors were assembled in an environment free from uncontrolled dust.
- Each unit was visually inspected for proper assembly.
- Labelled petri dishes were prepared for storage of impactor after sampling.
- Pretest calculations were performed to determine the proper sampling nozzle size.

Prior to Testing Each Day

- The sampling nozzle was visually inspected.
- The entire sampling train was leak-checked.

During Testing Each Day

- The impactor was allowed to warm to flue gas temperature before sampling.
- Isokinetic sampling was maintained within 10 percent.

After Testing Each Day

- Final leak-check of unit was done at maximum vacuum during test.
- Impactor was recovered following prescribed procedures.
- The impactor head was removed from the sampling probe, and sealed for transport to a clean disassembly area.
- Impactor filters were placed in pre-labelled dishes, and the impactor was cleaned for the next run.

Quality Control Procedures for Process Sample Collection. The process sampling quality control included the following procedures:

- The sampling equipment was cleaned and proper sample containers were used.
- Proper scheduling of sampling times was based on consultation with Niles staff.
- Immediate labelling of all samples was done at the time of collection.
- Observations were recorded on preformatted data sheets.
- Log-in and chain-of-custody procedures began as soon as samples were returned to the field laboratory.

METHOD 29 - MULTIPLE METALS

REAGENT PREPARATION

NOTE - NUTWLY, THIS GLASSWARE NEEDS TO BE SOAKED IN 10% HINDS FOR 4 HOURS IN A PLASTIC TUB, THEN RINSED 3X WITH DI HZO BEFORE ASSEMBLIND MAPINGER TRAINS

SRICA GEL INDICATINO 3 - 8 MESH NONE	RRISE FOR 45 & 46 IMPINGE (BN HCL 90AIL DI H20 IN 250AIL VOL. ADO TO VOLLIME WITH CONC HCL WITH COOLING)			
6 KANOA SAND B 1 DALY	900ML 10% H2SQ4 IN 1000ML VOL. FLASK ADD 40GM KMNO4, DISSOLVE DILUTE TO VOL. WITH 10% H2SO4		•	200-300 GM SLICA GEL (WEIGH) (RECORD)
ACIDIFIED 4% KANOA IMPINGERS 5 AND 6 MAKE FRESH DALY	BOOML 10% H2SO4 IN 1000ML VOL. FLASK ADD 405M KIANOA, DILUTE TO VOL. WIT 10% H2SO4		£	100M, ACOFFED KMNOA SOLUTION (WEIGH) (RECORD)
10% H2SO4	SOOML DI HZO IN 1000ML VOL. FLASK ADD 100ML CONC H2SO4 DILUTE TO VOLUME WITH DI HZO	ASSEMBLY	ĩ	100M, ACIDFED KMNO4 SOLUTION (WEIGH) (RECORD)
	RIC 13 1702 WE WITH	IMPINGER TRAIN ASSEMBLY	ï	EMPTY (WEIGH) (RECORD)
ACIOIFIED PEROXIDE IMPINGERS 2 AND 3 MAKE FRESH DALLY	SOOML DI HZO IN 1000ML VOLUMETRIC ADD SOML CONC. ULTRAPLIRE HNO3 ADD 333ML 30% HZO2 DILUTE TO VOLUME WITH DI HZO	iw.	2	150M, ACIDF ED PEROXIDE SOLUTION (WEIGH) (RECORD)
GLASSWARE RINSE SOLUTION 0 IN HNO)	VO3 : WITH DI H2O		2	150ML ACIDIFIED PEROXIDE SOLUTION (WEIGH!)
GLASSWARE RI 0 IN HINO3	BOOML DI HZO 8 JAN, CONC. HNO3 DL. TO 1000M; IN VOLUMETRIC WITH		=	DI HZO TO COVER INLET TUBE (WEIGH) (RECORD)
FRIER .	NON R		FILTER	
CYCLONES	¥ 20 2		CYCLONES (2)	

SAMPLE RECOVERY PROCEDURES

MPINGER #2 & #3 (ACIDIFIED PEROXIDE)	WEIGH AND RECORD COMBINE AND SAVE RINSE 3X WITH IN HAND! AND COMBINE WITH FR. TER SUPPORT RINSE AND RINSE OF MARKOER IT
MPHYGER 61	WEIGH AND RECORD SAVE AND LABEL RINSE 3X WITH IN IN IN IN ON AND COMBINE WITH FLIER SUPPORT RINSE
FILTER SUPPORT AND BACK HALF OF HOUSING	RINSE 3X WITH 0 1N H-403 AND SAVE
PROBELINER, NOZZIE AND SAMPLELINE	RNSE WITH ACETONE BRUSH WITH NON-METALLC BRUSH NON-RNSE WITH ACETONE RNSPECT LINER TO NSLRE ALL PARTICULATE REMOVED. F. NOT, REPEAT BRUSH-RINSE COMBREE WITH ACETONE RNISE FROM FRONT HALF OF HOUSING THEN RINSE 3X WITH 0 11H FRONT HALF WITH FRONT HALF WITH FRONT HALF WITH FRONT HALF
FRONT HALF OF FILTER HOUSING	BRUSH WITH NON-METALLIC BRUSH ACE TOWE COMBINE ACE TOWE COMBINE ACE TOWE RINSES AND LAUE THEN BINSE 3X WITH I HENS AND SAVE
FLTER	REMOVE FROM SUPPORT WITH TEFLON-CONTED TWEEZERS AND PLACE IN PLACE IN PETRI DISH PRATICULATE ONTO FITER WITH NON-METALIC BRUSH AND SEAL PETRI DISH WITH TEFLON TAPE
CYCLONES	EWP TY CONTENTS CONTENTS NOT C EACH NOT C EACH NATO SEAL AND SEAL NATH TEFLON TAPE

MAPRICER 84 MAPRICER 87 4 ME MAPRICER 87 MED MAPRICER 87 MED MARCH (SALICA GEL)
WEIGH AND RECORD WEIGH AND RECORD SAVE AND LABEL COMBINE AND SAVE DISCARD RINKS WITH RINKS WITH ACADERD DISCARD SAME GOTTLE SAMPLE BOTTLE SAMPLE S

METHOD 23/ MODIFIED METHOD 5

PAH, DIOXINS/FURANS, SVOC

IMPINGER ASSEMBLY

	ORO		IMPINGER #5	WEIGH AND RECORD DISCARD INTO PLASTIC BAG FOR RECYCLING
IMPINGER #5	FILL 1/2 FULL WITH 3-8 MESH INDICATING SILICA GEL WEIGH AND RECORD		IMPINGER #4	WEIGH AND RECORD DISCARD RINSE WITH 60/60 MECHICHICLI
IMPINGER #4	EMPTY		IMPINGERS #2 & #3	WEIGH AND RECORD DISCARD RINSE WITH 60/60 MEOWCHZCL?
II IMPINGERS #2 & #3	100ML DI H2O WEIGH AND RECORD	SAMPLE RECOVERY	IMPINGER #1	WEIGH AND RECORD SAVE AND LABEL RINSE WITH 60/50 MECHICH2CL2 AND ADD TO SAMPLE
IMPINGER #1	DI H2O TO COVER INLET TUBE WEIGH AND RECORD		SUMMA	SE VALVE
SUMMA			XAD/CONDENSER	CAP BOTH ENDS, WRAP IN ALUMINUM STG FOIL AND STORE AT 4C. CHESTER'S XAD TRAP WRAP ENDS WITH MUFFLED AL FOIL AND PLACE IN GLASS JAR.
XAD/CONDENSER			XAD/CC	
FILTER			FILTER	WEAR COTTON GLOVES REMOVE FROM HOLDER WITH TEFLON-COATED TWEEZERS AND PLACE IN PETRI DISH. BRUSH PARTICULATE ONTO FILTER AND SEAL DISH WITH TEFLON TAPE
CYCLONES (2)			CYCLONES (2)	POUR INTO SEPARATE CONTAINERS AND LABEL

WRAP ENDS WITH MUFFLED AL FOIL AND PLACE IN GLASS JAR. PACK WELL WITH MORE AL FOIL SEAL WITH TEFLON TAPE

(SAMPLING PERSONNEL)
RINSE WITH 6060
MECHCH2CL2
SAVE AND TRANSPORT
TO SAMPLE RECOVERY
WITH XAD CARTRIDGE
AND FILTER

METHOD 26A - ACID GASES, AMMONIA, AND CYANIDE

REAGENT PREPARATION

0.1M NAOH	SOOML DI H2O IN 1000ML VOL. FLASK ADD 4GM NAOH DILUTE TO VOLUME WITH DI H2O
0.1N H2SO4	SOOML DI H2O IN 1000ML VOL. FLASK ADD SGM CONC. H2SO4 DILUTE TO VOLUME
CO3/HCO3 SOLUTION	SUPPLIED AS A CONCENTRATE DILUTE 1/200 WITH DI H20

IMPINGER ASSEMBLY - ACID GASES

MPINGER #4	200-300GM 3-8 MESH INDICATING SILICA GEL WEIGH AND RECORD		IMPINGER #4	WEIGH AND RECORD DISCARD IN PLASTIC BAG FOR RECYCLING
IMPINGERS #2 & #3 IMF	03/HC03 ND RECORD	CID GASES	IMPINGERS #2 & #3	WEIGH AND RECORD POUR INTO SAMPLE BOTTLE RINSE WITH C03/HC03 SOLUTION ADD TO SAMPLE
IMPINGER#1 IMPIN	DI H2O TO COVER IN EACH INLET TUBE WEIGH AND RECORD	SAMPLE RECOVERY - ACID GASES	IMPINGER #1	WEIGH AND RECORD POUR INTO SAMPLE BOTTLE. RINSE WITH DI HZO AND ADD TO SAMPLE
FILTER	0045		FILTER	REMOVE FROM HOLDER WITH TEFLON-COATED TWEEZERS AND PLACE IN PETRI DISH SEAL WITH TEFLON TAPE
CYCLONE	(ESP INLET ONLY)		CYCLONE	EMPTY AND SAVE

METHOD 26A - ACID GASES, AMMONIA, AND CYANIDE IMPINGER ASSEMBLY - AMMONIA

- -		IMPINGER #4 WEIGH AND RECORD DISCARD IN PLASTIC BAG FOR RECYCLING
IMPINGER #4 200-300GM 3-8 MESH INDICATING SILICA GEL WEIGH AND RECORD	NIA	IMPINGERS #2 & #3 WEIGH AND RECORD POUR INTO SAMPLE BOTTLE RINSE WITH 0.1N H2SO4 SOLUTION ADD TO SAMPLE
IMPINGERS #2 & #3 100ML 0.1N H2SO4 IN EACH WEIGH AND RECORD	SAMPLE RECOVERY - AMMONIA	WEIGH AND RECORD POUR INTO SAMPLE BOTTLE RINSE WITH DI HZO AND ADD TO SAMPLE
IMPINGER #1 DI H2O TO COVER INLET TUBE WEIGH AND RECORD	SAMPL	FILTER LEAVE IN PLACE WE FOR NEXT RUN BO
FILTER		
CYCLONE (ESP INLET ONLY)		CYCLONE EMPTY AND SAVE

RINSE WITH 0.1N H2SO4 SOLUTION ADD TO SAMPLE CHECK pH < 2

METHOD 26A - ACID GASES, AMMONIA, AND CYANIDE IMPINGER ASSEMBLY - CYANIDE

3 IMPINGER #4	200-300GM 3-8 MESH 3RD INDICATING SILICA GEL
IMPINGERS #2 & #3	100ML 0.1M NAOH IN EACH WEIGH AND RECORD
IMPINGER #1	DI H2O TO COVER INLET TUBE WEIGH AND RECORD
FILTER	SAME FROM PRECEDING RUN
CYCLONE	(ESP INLET ONLY)

SAMPLE RECOVERY - CYANIDE

IMPINGERS #2 & #3 IMPINGER #4	WEIGH AND RECORD WEIGH AND RECORD POUR INTO DISCARD IN PLASTIC SAMPLE BOTTLE BAG FOR RECYCLING RINSE WITH ADD TO SAMPLE CHECK pH > 10
IMPINGER#1	WEIGH AND RECORD POUR INTO SAMPLE BOTTLE S/RINSE WITH DI H2O AND ADD TO SAMPLE OF
FILTER	REMOVE FROM HOLDER WITH TEFLON-COATED TWEEZERS AND PLACE IN PETRI DISH BRUSH PARTICULATE ONTO FILTER AND SEAL WITH
CYCLONE	EMPTY AND SAVE

MODIFIED METHOD 0011 - FORMALDEHYDE

REAGENT PREPARATION

ACIDIFIED DNPH (DINITRO PHENYL HYDRAZINE) REAGENT EMPTY PREWEIGHED ALIQUOT OF PURIFIED DNPH INTO 1000ML BOTTLE OF ACETONITILE, ADD 0.200 ML CONC. H2SO4 STORE UNUSED PORTION AT 4C UNTIL NEEDED

IMPINGER ASSEMBLY

(NOTE - THIS METHOD USES MINI IMPINGERS)

CYCLONES	FILTER	IMPINGER #1	IMPINGER #2 & #3	IMPINGER #4
NONE		DI H20 TO COVER INLET TUBE WEIGH AND RECORD	20ML ACIDIFIED DNPH REAGENT WEIGH AND RECORD	SILICA GEL, 3-8 MESH, INDICATING WEIGH AND RECORD

SAMPLE RECOVERY

FILTER	IMPINGER #1	IMPINGER #2 & #3	IMPINGER #4
REMOVE	WEIGH AND RECORD	WEIGH AND RECORD	WEIGH AND RECORD
AND	POUR INTO	POUR INTO ONE	DISCARD INTO
DISCARD	SAMPLE BOTTLE	SAMPLE BOTTLE	PLASTIC BAG
	RINSE WITH DI H20	RINSE WITH ACN	FOR RECYCLING
	AND ADD TO SAMPLE	(ACETONITRILE)	
		AND ADD TO SAMPLE	

APPENDIX D

FIELD SAMPLING DATA SHEETS

APPENDIX D

FIELD SAMPLING DATA SHEETS

In this Appendix, copies are provided of the original field sampling data sheets and calculation spreadsheets from the field study at Niles Boiler No. 2. These sheets show the data recorded by the Battelle and Chester staff in conducting the flue gas measurements. The data sheets are organized in the following order:

- D-l: Modified Method 5
- D-2: Multi-Metals
- D-3: Anions Train
- D-4: Ammonia Train
- D-5: Cyanide Train
- D-6: Aldehyde Train
- D-7: VOST Train
- D-8: HEST Samples
- D-9: Cascade Impactors
- D-10: PSDS Sampler
- D-11: High-Volume Sampler (Soot Blowing)
- D-12: Flue Gas Sampling Calculation Spreadsheets.

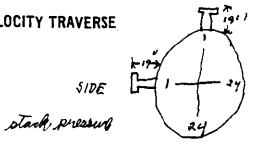
Within Sections D-1 to D-11, the data sheets are presented in order by site and date. For example, in Section D-1, data sheets from sites 4, 5a, and 5b on July 26 are provided, followed by those from sites 4, 5a, and 5b on July 28, etc.

Section D-12 shows the calculation results for each of the isokinetic, traversing sampling runs at Niles Boiler No. 2. These results include primary flue gas characteristics, as well as derived values such as isokinetic rate, flue gas volume flow rates, etc. The results are presented for Locations 4 and 5a.

D-1: Modified Method 5

PRELIMINARY VELOCITY TRAVERSE

PLANT <u>rules, Ohis</u> DATE <u>7/26/93</u> LOCATION <u>ESP mlet</u>	
DATE 7/26/93	
LOCATION ESP MULTI	4
STACK I.D	
BAROMETRIC PRESSURE, in. Hg	
STACK GAUGE PRESSURE, in. H ₂ 0	2
OPERATORS Lement Numb	



SCHEMATIC OF TRAVERSE POINT LAYOUT

5	į	1	ú	_
~	1	u	7	_

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp _s), in.H ₂ O	STACK TEMPERATURE (T _s). *F
	0	197
2	0.01	280
3	0.37	305
4	0.61	3/2
<i>4 5</i>	0.79	313
6	0,86	3/1
7	0.90	311
8	0.94	310
9	0.92	310
10	0.92	303
11	0,92	308
12	0.85	306
13	0.83	305
14	0.83	304
15	0,83	303
16	0,82	302
17	0.81	301
18	0.79	30]
19 20	0.78	300
20	0.73	299
2)	0.70	299
22	0,63	298
23	0.57	=96
24		
AVERAGE		

EPA (Dur) 233	_	200
4/72	~ 0.82	300

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δρ _S), in.H ₂ O	STACK TEMPERATURE (T _s), °F
]	0	208
2	0,39	267
3	0.55	297
4	0.64	299
	0.72	300
6	0.78	300
7 8	0.88	300
8	0.90	300
9	0.91	300
10	0.94	301
11	0.91	302
12	0.91	303
1.3	0,78	307
14	0.27	308
15	0.78	309
16	0,79	310
17_	0,80	310
18	0.81	311
19	0.80	311
20	0.77	31/
2/	0.71	3/2
22	0.65	312
23	0.63	312
24	0.60	3/2
AVERAGE		

NOMOGRAPH DATA

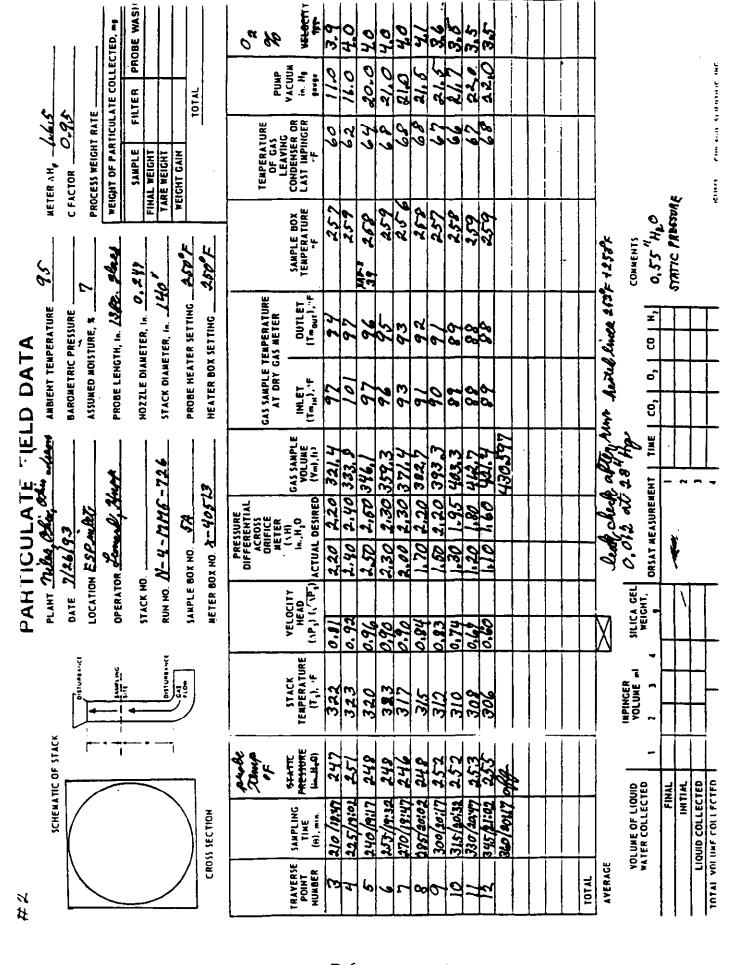
PLANT_	niles.O	hir.	Ohio	Edwan	
	7/26/	-			
	G LOCATION		•		
	N-4-				

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ 0	ΔHe	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	T _{mavg.}	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B _{we}	7
BAROMETRIC PRESSURE AT METER, in. Hg	Pm	
STATIC PRESSURE IN STACK, in. Hg		
(Pm±0.073 x STACK GAUGE PRESSURE in in. H ₂ 0)	Ps	
RATIO OF STATIC PRESSURE TO METER PRESSURE	Ps/Pm	1.0
AVERAGE STACK TEMPERATURE, °F	T _{Savg.}	310
AVERAGE VELOCITY HEAD, in. H ₂ 0	Δp _{avg} .	0.85
MAXIMUM VELOCITY HEAD, in. H ₂ O	Δp _{max} ,	1.00
C FACTOR	4	0.90
CALCULATED NOZZLE DIAMETER, in.	0.	235
ACTUAL NOZZLE DIAMETER, in.	0. ;	247
REFERENCE Δp, in. H ₂ O	0,7	50

EPA (Dur) 234 4/72

Checked by:_____

C FACTOR 0, 95. PROCESS WEIGHT RATE SAMPLE FILTER PROBE WASH TARE WEIGHT TARE WEIGHT TOTAL	PUMP VACUUM in. Hs	79 3.6	79 150	80 17.5 4.0	21.5	76 22.0 40	50 40 39 1	Change alter at 15 way teins
93 60. 942 90" 250° F 250° F	SAMPLE BOX TEMPERATURE	260	-	25.9 compared to 15.5 c	1 1	4a 250 14	257 3th	EEZ15
MEATER BOX SETTING 250°F.	GAS SAMPLE TEMPERÁTURE AT DRY GAS METER INLET (Tminl.'F (Tmous),'F	102 99		103 108		97 97	16 76 16 16	Redb Lub 349 252°F CO, CO N,
26 June 12	PRESSURE DIFFERENTIAL ACROSS ORIFICE WETER (1.H) In.H,O VOLUME ACTUAL DESIRED (Ym), is	1.65 1.65 187.1	1.30 2.30 197.4	435 4.35 420.2	2.20	1.90 1.70 289.2	0,40 0,40 306,551 1,20 1,20 312,3	CLAN CRUN AT 1514 DO 15 AND ORSAT MEASUREMENT TIME
PLANT TULES PLANT TULES PLANT TULES DATE 7/26 DATE 7/26 STACK NO. STACK NO. NO. STACK NO. METER BOX NO. A	STACK VELOCITY TEMPERATURE HEAD [1], F (NP.) (\neq.)	303 043	0,89	7500	26.0		3/0	MI SILICA GEL
MATIC OF STAC.	SAMPLING PRESSURE TEMPE (6), min.	14:17 260	135 241	15:17 248 15:32 149	16:02 249	14:32 353 16:47 251 17:02 256		VOLUME OF LIQUID VOLUME OF LIQUID VOLUME VOLUME VOLUME INITIAL INITIAL LIQUID COLLECTED OI 11MF COI 1 FCTFO
SCHEI CROSS SECTION	TOP TRAVERSE SAM POINT T	19	30,7	75	150	1591 21 1031 11 1581 01	171	AVERAGE VOLUME OF LIQUIO WATER COLLECTED INITIAL LIQUID COLLECTED TOTAL VOLUME OF LIQUID



CLIEN	CLIENT BAR 10	/ DUE		TEST DAT		SA	MPLING I	OATA SHEET ORIFICE CORRECTION	HEET	10N //57	12	HOT BOX NO.	Page of 4 NO. 4 NO. 4-24	
PROJECT N	TEST UNIT SEC. PROJECT NO. 9	TEST UNIT SELL - AN SIGNIFICATION OF SELECT NO. 93C & 28-4	d de	NOZZLE (SIZE	SIZE, A	21 -	160	CALIBRATION DATE	FION DAT	, i T	2	PROBE NO.5	10	
BAROM	CONTROL BOX OPERATO BAROMETRIC PRESSURE	RESSURE 29	00.	PORT DIRECT		¥ () ¥	0	CONTROL BOX NO.	BOX NO	300		STACK DIA.	A. ERE" (52.*	
Tonogra	Tile	Dry Gas	Pitot A P	jo	Orifice A H	Moter Te	aperature	Vacroun	Sack	Prote	Impiager	Hot Box	Connects	
2		Meter Reading	100	Req'd.	Ad.	ة و م	\$ E	(i. He)	1000 1000	Temp (*)	Temp.	Tong G.E.		
SO (Market)	1300	(A) (A)	(B. H.CU)	760	16.0	00/	016	7	162	-28F	208gF	7.82-	30 men / prop	N
		00000	17	9	160	80/	26	45	162				Redimes	
1),	16:0	160	1/3	8)	6.5	682				5 min 1	
	-)")	16.0	0.91	115	701	6-0	289					
+)	16.0	16,0	(8)	104	6.0	736					
1>)')	16:0	٦,0	6//	901	6.0	289					
20.00	1230) '	160	16'0	(22	80/	6-0	682					
			111	260	26'0	123	9//	6.0	289					
\perp			///	26'0	24.0	121	011	16.0	289					
-			1.7	26.0	26.0	124	112	6.0	289				-	
		-	0 -	9 %म	0.84	125	112	6.0	210					
>			0/	78	18.0	136	113	0.0	290		ļ			
4.8	300		1.0	44.	46.	127	114	6.0	383					
	1		080	69	.67	126	. 14//	5.0	290		!			
			25	<u>,</u>	63	127	115	5.0	290				Ectimates:	
	_		75	63	65	127	ربا	2.0	2%				MW-29.3	_
			7	63	.63	126	7/1	6:0	280				×H20-7	
>	1330	50600	.75	.63 .63	63	196	3//	2.0	296		•			0
SYSTEM	M LEAK CHECK	HECK	_	PITOT LEA	K CHECK	25.			induit.			laidel	Difference At	<i>'</i> '
	Vacuum	<u> </u>			Positive	Negative		Z	3 1	100 to 100 to 100	0.0%	2.144	39.4 Mo.	the
;	+	+		Afre	0 K/1/20	0		7.	1		1/63	1810	10.2.01	2,
AA	1/c	0.000	<u>.</u>		- (120 m	1		3.	A 1 00	LAS	366	144.5	1	2
1-	-me - 90m	7		Ш	557	15:37			Dank D	24/20	520.7	5,63	8//	7
Ř	ME=4	vame= 42.94+ dd	, se	8	40	Ş		411	27/16	1 2	(A ()		2.88.29	数
\ \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	(SH) AC =	- 0.87	,	ž	110	77.0	<u> </u>	Ser Ag	<i>SII</i> _ !	Ţ	start = 6+62	O CONTRACTOR	EYSTONE	-
AQE 2	, , w	1 00	7	lyphetis cheev	_	4 FC	، ،	121 1	1	12,00	-7 C	17 ME 1		

						STACE	STACK SAMPLING DATA SHEET	I SNÏT	SATA S	HEET				Page 2. of 4
	THE IT	Roth!	1/2 tane		TEST DA1	ATE 726-93	. 63	(Mar.)	ORIFICE CORRECTION	ORRECT	10N 1.572	72	HOT BOX NO.	¥
	TEST UN	TEST UNIT STALL	111	do,		1	SMV	726	METER CORRECTION	ORRECTI	_ N	57	COLD BOX NO.	NO.4+34
	PROJEC	T NO. 9	PROJECT NO. 93CB 28-6	2		E (SIZE, f)	1.17		CALIBRATION DATE	PECATION	YC	•	FILTER NO	250
	CONTRC	CEPIC PE	CONTROL BOX OPERATOR 17	218 20 00	PORT DIR	RECTION	11:0 25) = C	CONTROL BOX NO	BOX NO			STACK DIA	135"
	DANG	2	11)	}		N. editor	Meter Ter		Vacwen	Stack	Probe	Smpinger	Hot Box	Commonta
	Treverse		original and		P. 00	A	=	ð			ig.	Temp	Temp.	
			(def)	(s. H20)	(j. H20)	(in. H20)	(F)	(Gr. Hg)	(F)	£	(4°F)	(£)	
7		12.26	0	0 /	. 74	40	112	115	C.	2,0	738%	48%	7,052~	Vomi port
<u> </u>	ŊŢ.	-1	-1	(2)	40	B	02/	9//	6.0	262				Raches even
					4,4	40	201	1//	0 3	160				Some 1
					44	78	129	1/6	0.7	210				
				0	178	48	127	211	C. C	212	i			
	-			6)	7.2	7	130	1.77	6.0	168				
9.3				0,	84	1%	123	117	6.5	280				
				01	48	40	129	117	20	292				
_				0	7.6	7.0	150	8/1	7.0	213				
_				0/	1.8	48	087	8//	7.0	747				
	-				184	18	(3/	811	7.0	292				
	 			0.7	44.	40	130	//8	7.0	293				
6	£.8	_		. 25	.63	63	/3/	118	6.0	290				
)				72.	63	63	130	118	6.0	3750				
				25.	٤٦.	ني.	730	118	6.0	271				
		\ \ \		25	53	.63.	130	118	6.0	31-		·		MW= 29.3
	-			175	63	63	130	118	6.0	390				%H20- 7
	>	70.31	096.466	36.	. 63	.03	131	8//	0.9	2%				
	SYSTEM	SYSTEM LEAK CHECK	ECK		PITOT LE/	EAK CHECK			Impinger		Impieger		Liting	Difference
		Vectors	DOM Rate			Positive	Negative		2	5	Contents			
		(in. Hg)	(c(m)		Before									
	Before	ا و	X00155		A]		•		•			
į	AAm	2	K0.015CC	(8	16.6	•		;].			
Ž,	TIME	TREE - good	3	,	3 8	27			*					
\$	ž	, 133m	variate 45.776 det	<u>. </u>	8	0		17	7621=	\$. 77	velox	reloisty = U.A. I Also	7	4
3	,	1 (ab)	(AD) AR = 0,9°		Z	72.0		•	% -	. !		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		KEYSTONE
 '	AQ6 2/92	IAIL	22.2					/ta.1	J 2	- 2118	13	150. =75.0%		7

		,				STAC	STACK SAMPLING DATA SHEET	LING	DATA!	SHEET				Page 3 of 4	
	CLIENT	CLIENT Partolle	1 lave		TEST DA	ATE 7-26-93		(JQ)	ORIFICE	CORRECT	ORIFICE CORRECTION 1,572	72	HOT BOX NO.	NO. 4	
	TEST U	NIT SX	194-7	Ste	TEST NO.	V	- Sww-	726	METER C	METER CORRECTION	9/0 /7 NO	51	COLD BOX NO. 4	(NO. 4+34	
	PROJEC	7 00.	1	10		E (SIZE, D)	2,142		CALIBRA	CALIBRATION DATE	`	73	PROBE NO.	5:3	ı
	CONTR	OL BOX (H	<u>ح</u>		PRESSURE	- 1.0. ReD	Q	PITOT CC	PITOT CORRECTION	10.0 N		FILTER NO		ļ
	BAROM	ETRIC PI	BAROMETRIC PRESSURE 2	9	POKT DIK	IRECTION	PORT	ال	CONTRO	CONTROL BOX NO.	1		STACK DIA.	A. E. 132.	.
	Traverse	Time	Dry Gee	Pitot A P	O	Orifice A H	Meder Tems	mperature	Vecuent	Stack	Probe	Impinger	Hot Box	Coraments	\bigcap
	Poist (ischas)		Mater Reading (dcf)	(is. H2O)	Req'd. (is. H20)	Act (is. H20)	(4.) ¶	# (£	(is. Hg)	ļ.	Tomp.	Temp.	رج (ع)		
39.1	_ `	15/8	8,550	0.7	78'	1.8	72	6//	7.0	290	~290×	£89>	~250E	Brown / par	I
				0.7	48	78	126	′′′	7.0	290				Reading	1
				77	92	. 92	130	611	7.0	291					1
		!		7.7	, 82	93	130	377	2.0	296					
	_			1.2	101	1.01	133	8//	7.5	297					
	\Rightarrow			1.2	10.1	/. 0(182	119	7.5	217					
<u>6</u>	M			1.3	66	- 99	132	120	2.0	292					
				1.2	99.	166	15>	120	7.0	297					<u> </u>
	_			4.	88	66	732	120	٥, ۲	396					
				6.2	9.9	99.	133	120	7.0	298				•	
				7.3	66	. 91	132	120	7.0						
	>			1.2	96.	61.	132	02/	7.0	378					
5	6.8			1.2	199	66	/30	121	20	288					
				1.2	99	.99	730	121	7.0	296					
				47	66.	99	134	120	7.0	29%				Estimates:	7
~				7.7	46.	. 99	132	(3N)	٥٠٢	296		·		MW-29.3	\neg
				1.2	.99	. 99	132	00)	0.5	290				×H20-9	
	>	84.71	320 151 84 91	12	99	.99	132	120	7.0	297					\neg
	SYSTEM	SYSTEM LEAK CHECK	ECK	•	PITOT LEAK				lapinger	Impiager	Ē	;		:	
		Vacuuta	DOM Rate			Positive	Negative		Š	Contents	3	Fig.	[eitie]	Difference	
		F. Hg.	(din)		Before				-						
	Before	0.0	×0.0/5/5/		Aber				2.						
_ 	ABer	3.6	20.01C CO	•		-	1								
TA TA	TIME	TIME = 90 mc	mei.		203	15.5			→ .						
£	167	2 - JAKIEL	91.528 dcf		8	45		ب •	- - -	١	1		R		
des	>	(40)	(AD) = = (.2		2 2	20		take	/As = 12	=1254	16 8	100 to 14:37		1	
	AQE 2/92	₹ -	70	_				11	_	d	(1000	デン (A)	TINION COLUMN	
•								1 717	4	-/- Xhe	2 63		ا د د		

		`	`			STAC	K SAM	STACK SAMPLING DATA SHEET	DATA!	SHEET				Page 4 of 4
,	CLIENT BALLE	Bertoli	6 POE			ATE 7-26-93	- 93	(1401.)	ORIFICE	ORIFICE CORRECTION	TION 1,572	72	HOT BOX NO.	NO. 4
•	TEST UNIT 5	IND ON T	12 14 - 42 S	0	○ Ire	CSIZE ASS	5mm-	- 726		METER CORRECTION CALIBRATION DATE		5/	COLD BOX NO	(NO. 44-54
•	CONTRO	L BOX	CONTROL BOX OPERATOR	175		PRESSURE	-1.04AD	Q	PITOT CC	PRECTK	0	3	FILTER NO). 25 J
. '	BAROMI	TRUC PI	BAROMETRIC PRESSURE 2	9.00	PORT DIR	IRECTION	PORT	4	CONTRO	CONTROL BOX NO.	D. G		STACK DIA.	A. T. 132"
	Traverse	Line	Dry Cas	Pitot A.P.	δ	Orifice A.H	Moter Temp	emperature	Vacous	Spek	Probe	Impiager	Hot Box	Comments
-	Point Sechos)		Moter Reading (def)	(je. H2O)	Req'd. (is. H20)	Act. (ls. H20)	≖ €	3 5	H	1	1 E	T. C.	Te e	
7.6	A STATE OF THE PROPERTY OF THE	1705	15/350	├	16	16.	00	8/1	2.5	299	7,852~	4684	7886~	Davis but
•	-			7.7	16	16	130	120	7.0	28				Rechale
				//	16	16	132	120	2.0	300				1.2
•				1.1	16.	16	132	120	7.0					
•				12	. 99	66	851	120	2.0	Ľ,				
	>			/2	66	61	(3)	120	7.0	300				
6)	4			1-1	16	16.	132	021	0-6	708				
<u>-</u>				1.1	16'	76'	132	120	2.0	30/				
				1.2	66	66	737	120	0.6	30/				
				1.1	18.	.91	134	120	0.4	30/				
•			•	1.1	76.	.91	133	120	7.0	300				
	\			12	98	.91	132	120	2.3	300				
7	6,3			10	58	. 23	133	120	6.0	30/				
				1.1	16'	.91	133	120	6.0	30/				-
L				71	166.	. 99	133	121	6.6	30/				Estimates:
				1.2	.99	99	133	121	20	300		·		MW-29.3
لب				1.1	.91	16	135	1033	70	⁄જ				8H20-9
	>	18.35	199.940	1.1	.71	16.	1.34	121	7,0	300				
⊸ 1[SYSTEM LEAK CHECK	EAK CH	ECK	-	PITOT LEAK	K CHECK			Impieger		Impiager	i	•	!
		Vacuum	DOM Pate			Positive	Negative		훘	3	Contents		lection	Difference
		i E	(c(m)		Pefore									
1_	Metore	0 0	1000		Affer	-	7		7		•			
7500 L	7	746 = 90	2 2 2		200	15.5			-					
	֡֞֞֞֝֞֞֞֝֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓		100 ON	ť	07	52			8					
	§ ,	ן קר קר	ionolo: Ot - almon	<u> </u>	8	0 2		(Touch he	1 = 126%	97	Morty	1=21.34	E.	7
<u> </u>	AGE 201 AP/AG = 1.1	1P/A6	<u> </u>		72	140		; 		. '	_ \v.	65162		KEYSTONE
-		;	١٠٥٥				-	1012 1	` \	٠, ٥٠٠		()	•	

	(K SAME	LING	STACK SAMPLING DATA SHEET	HEET		1 (0	4 ON YOU TOU	Page t of S
a g	202		TEST DAT	E 7-2(0 R/3	ORIFICE CORRECTION 721, 714. METER CORRECTION 731, 714. TOLCALIBRATION DATE	ORIFICE CORRECTION METER CORRECTION CALIBRATION DATE	ORRECTION DA	Z	1049 110-93	COLD BOX NO PROBE NO.	NO.
PERA	CONTROL BOX OPERATOR D. F. BABONIER 29 /	Blank		RESSURE			PITOT CORRECTION CONTROL BOX NO.	RRECTIC BOX NO	1/19	ou them.	FILTER NO	A.
٤	1	Pice A P	٥	Orifice A H	Meter To	Temperature	Vacuum	Stack	Probe	Impine	Hot Box	Contractals
Mate		5	Rae'd.	Ad	# 6 6	3 6	(in. Hg)	Į.	Temp.	Temp.	Temp.	
12/	C X		0.7	0./	105	102	#	X		00	-	
-19	4	\$	7.0	0%	())	63	ý			7.9		
1/2	2		0,7	0	122	8	<i>*</i>			63		
X	77	-	0,	0.	126	3	<i></i>			63		
35	25.0		0	0,1	130	113	ħ			181		
7	7,7		0	Ó	130	15	7			63		
15	44	-	0	7.6	32	1/1	7			58		i
		-)	7.	121	×:	Z	-		23		
16	7		1	1,7	134	6	ל			57		
4	× 0		1,7	1,2	131	120	7			57		•
15	10.5		2	7:1	125	121	-3"			57		
1	7.7		7	27	136	121	<u> </u>	-		56		
7,7	100		1.7	<u>ا</u> .	137	17)	\>			2		
124 DIO	0.7.7		1.5	۲,	137	122	5			52	<u> </u>	
36	•	-	\ <u>\</u>	\\ \'\	132	122	5			53		Estimates:
10	20	-	7	4.	138	727	ک			53	-	MW-
90	10		4	<u>t.</u>)	- 1	123	V		_	53		%H20-
1		 	1	4.	130	125	7		-	98		
LEAK CHECK	1		PITOT LE			_	Impinger	<u>E</u> ,	Impiaget		1177	Difference
8	DOM Rate			Positive	Negative		<u>.</u>	3	Contents			- Tank
	(c(m)		Before				- -					
9	95		VPer	_ -	,		4		,			
174	CUX		5	-	•		•					
			3 8				8					
			8			,					الما	7
			Z								χ.; Σ	KEYSIONE
											ل	7

S 20				mende																				j	.		T	7	T	7	ONE	H 1100
Page 2 of 3	Q	2		Com																Estimates:	Z K	%H20-									FYST	
	HOT BOX NO.	PROBE NO.	STACK DIA	Hot Box	Teng (†f)				•																						KEY	
		25-91-	Kacl	Inpinger	Temp. (*C/*F)	55	45	53	53	52	53	52	2,3	54	52	53	54	54	S	5.3	5.3	\$3	53	i								
		-1c	0. 2 Par	Probe	ţe																_			Impieger	Contents		•					
HEET	ORREC	TION DA	BOX N	Sect	į	1																1		Ĭ,	3							
STACK SAMPLING DATA SHEET	ORIFICE CORRECTION		CONTROL BOX NO.	Vacuen	ê. H.	٧	V	7	>	7	5	5	5	8	5	V	- 5	5	7	5	5	٧:	\ <u>\</u>	Impiette	Š	<u>-</u>	,	-			٠	
LING	~	-MM5-726		Meter Temperature	8 E	123	(23	123	123	123	123	24	961	124	1255	011	7	(25	571	725	125	126	ر 27									
K SAMF	7			Meter Te	• £	139	38(-)	139	1 39	134	1395	94	140	140	Oh 1	<u>2</u>	140	140	QH.)	13)	1 41	14.2	141	`[Negative			7				i
STAC	TE 6 2	(SIZE, NU-	ECTION	Orifice A H	Act.	7.7	4.1	七	1.9	0	6,	1.9	6.	1.9	6	6.	(.9	6 37	67	(3)	6/	14		AK CHECK	Positive			-[
	TEST DAT	NOZZLE	PORT DI	5	Reg'd.	17	1+	7.	0.	δ.	6	6	\$,	6	6	5	1.0	δ,	1:0	611	5~	2		PITOT LEA		Before	Alber		3 8	3 8	3	
		5)	0.	Pitot a P	(jr. H20)		-										-	-			_											
	2000	1000 B	BAROMETRIC PRESSURE		Meter Reading	3010.9	3/5/	227.10	23.6	∙ `	247.2	·l	לניית ל	12	321.7	2889	1820	415.8			10.05	420 6	448.2	ECK	DOM Rate	(c(m)						
	Ratel	17 (1987) NO. 932	L BOX O			752	\sqrt{V}	XXX	¥09.	\ <u>\</u>	100	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	707	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	1,000 1,000	シャ	ンパー	7257	17.4	17,75	-25.7.	(A)	3	LEAK CHECK	Vecum	(is. Hg.)						
	CLIENT RAHELLO	TEST UNIT & PROJECT NO.	CONTRO	1	a d													:						SYSTEM			Before	After				AQE 2/92

					STAC	STACK SAMPLING DATA SHEET	PLING 1	DATA S	HEET				Page 3 of 3	~
CLIENT D	CLIENT SCHEME	Me Dos	7, 13	TEST DAT	E ~	ا اف	7.76	ORIFICE CORRECTION	ORRECT	z	1.521	HOT BOX NO.	NO.	
CONTROL BO	CONTROL BOX OPERATO	× 2	- 8 m	NOZZLE (Synwystatic Pi	(SIZE,A) PRESSURE	15-N51	3-MM5-72K	N-58-MM5-724 CALIBRATION DATE PITOT CORRECTION CONTROL BOX NO.	RRECTK BOX NC	41/2	14 -93	PROBE NO. FILTER NO. STACK DIA	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
Traverse	Time	Dry Ow	Pitot A.P.	ō	Orifice A.H	Meter Te	mperature	Vacuum	Steck	Π^{-}	Impinger	Hot Box	Commonda	
Point in		Moter Reading	(js. H20)	Req'd. (in. H20)	Act (bs. H20)	al (F.)	# (£	(in. Hg)	Temp. (*F)	(F)	Temp. (*C/*F)	Temp.		
	1035	JK1.3	1	2.0	1,9	142	123	2	-	H	52	1		
	18/7	11/04.55		ا. م ا	1.9	192	123	>			20			- "
		1								_				
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			-											-
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			-											
:														
													٠	
													Estimates:	_
													₩ -	
													×H20-	
									·	-G		`		
SYSTEM	 }-	ECK	<u> </u>	PITOT LEA	AK CHECK	Nepativa	-	impuser. No	ĖŠ	impusger Contents	ř.	laitin.	Difference	
	Vacuum Va	Cefa)		Before										
Pefor	┽╌	↓	.	After				2.		·				
Š					-	1		3.						
				700				-						
				20 25				^]	
				3 %								¥ ک	KEYSTONE	五
AQE 1/92	2											٣		ļ

PLANT Niles Ohio	Ohio Edison
DATE 7/28/93	
SAMPLING LOCATION <u>ESP</u>	inlet
N-4-MM5-720	

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔHe	1.45
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	T _{mavg.}	100
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B _{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	Pm	28.84
STATIC PRESSURE IN STACK, in. Hg (Pat ± 0.073 x STACK GAUGE PRESSURE in in. H ₂ 0)	Ps	
RATIO OF STATIC PRESSURE TO METER PRESSURE	Ps/Pm	1.0
AVERAGE STACK TEMPERATURE, °F	T _S avg.	310
AVERAGE VELOCITY HEAD, in. H ₂ O	Δp _{avg} .	0.90
MAXIMUM VELOCITY HEAD, in. H ₂ D	Δp _{max.}	1.20
C FACTOR	4	7.95
CALCULATED NOZZLE DIAMETER, in.	σ,	230
ACTUAL NOZZLE DIAMETER, in.	0.	182
REFERENCE Δρ. in. H ₂ O	2,	15

EPA (Dur) 234 4/72

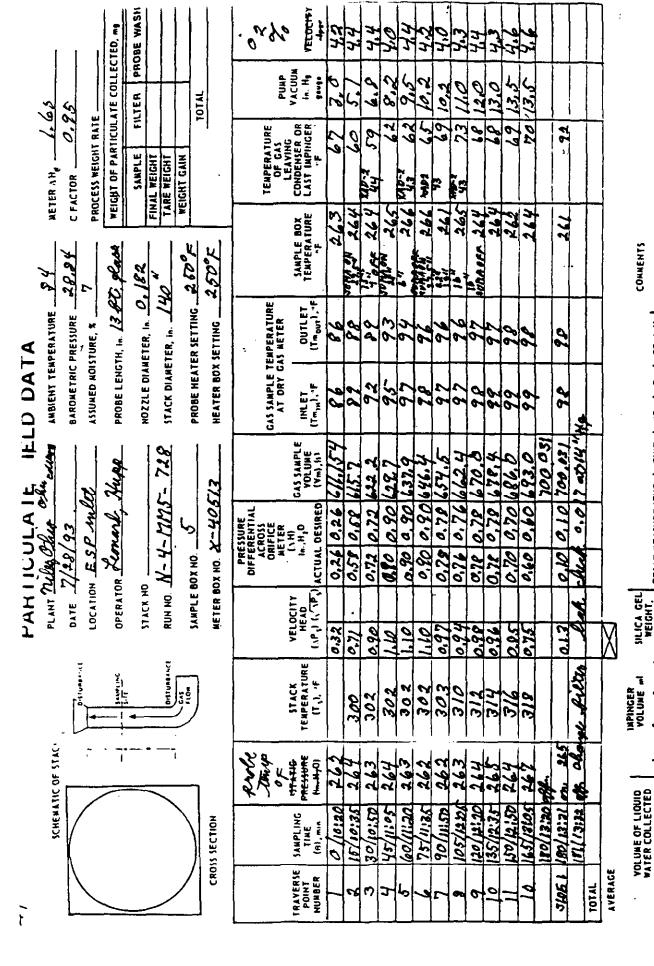
Checked	by:	

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ORSAT MEASUREMENT | TIME | CO.

FINAL



C FACTOR 2.95 C FACTOR 2.95 PROCESS WEIGHT RATE SAMPLE FILTER PROBE WASH TARE WEIGHT WEIGHT GAIN TOTAL	TEMPERATURE OF GAS LEAVING CONDENSER OR	LAST IMPINICER In. He seuge	1 2 82 4.0 43	76 2.0	12 63 P. O 4 L	07/ 79	69 11.0 4				W. 62 12	66 12.0 4.2	1836			Cless com som se destroit me
20 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		TEMPERA	452	272	273	273	474	2/7	1	27%	273	2/3	14 257 F+ 253°	COMMENTS		
AMBIENT TEMPERATURE BAROMETRIC PRESSURE 28 ASSUMED MOISTURE, X PROBE LENGTH, In. 1300 NOZZLE DIAMETER, In. 140 STACK DIAMETER, In. 140 PROBE HEATER SETTING HEATER BOX SETTING	GAS SAMPLE TEMPERATURE AT DRY GAS METER	(Imaur), *F	29	100	100	100	60	1 1		46	23	2	Seated line		CO K,	
PROBE LENGTH, In. 12. STACK DIAMETER, In. 13. STACK DIAMETER, In. 14. STACK DIAMETER, In. 15. STACK DIAMETER, In. 16. STACK DIAMETER, In.	GAS SAMPLE AT DRY	(Tm _{1M}). 'F	101	100	100	66	66	T		93	93	73	.018	A. 2.	(0)	
7 7 7 7	<u> </u>		718 001	┿		-		17.2. 10	905 1996	757.3	7	772.7	last let after 0.012	Se .	MENT TIME	- ~ ~ ~
PLANT THE ORIGINAL ORIGINAL ORIGINAL ORIGINAL OPERATOR SEMENT THE STACK NO. N-4-1785-728 SAUPLE BOX NO. S-40513	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (N H)	∡ . ⊏	0.34 0.24	++	0.72 0.72	-	72	0.74 0.74		0.70 0.70		0,53 0,53	les ter	,	ORSAT MEASUREMENT	¥
PLANT TILES DATE 7/20 DATE 7/20 DOPERATOR 65 STACK NO. N-BRUN NO. N-BANNO.	VELOCITY	() ()	0,49		0.90			0.7		0.70		0.65	X	SILICA GEL		
2) 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	STACK	÷ F	312	3/9	3/6			and som		301	300	477		IMPINCER Volume ==1	7	
SCHEMATIC OF STAC	34年		263				.	off 26	i		263	7		OUIO -	-	FINAL INTIAL ECTED
SCHEM CROSS SECTION	SAMPLING	Ē	195/14:32	210/14:47	2031/202	255/15:3	270/ISW	183//F.	290/1829	7h: 91/5/E	10:11/05	340/17:16	بو	VOLUME OF LIQUID	WAIER COLLE	FINAL INITIAL LIQUID COLLECTED TOTAL VOLUME COLLECTED
1 ±	TRAVERSE	POINT	-	m	34	e		00	Ø (*	=		AVERAGE			10741 V

1532 Page 1 of 4

1 LOTE COLD BOX NO. 4

COLS ON STATES NO. STATES NO. CALS STACK DIA. 132

						STAC	STACK SAMPLING DATA SHEET		DATA S	HEET				Page 2 of 4
	CLIENT	6471546	SUG 1000		TEST DAT	3	07-28-21 (Wed.	(Wec).)	ORIFICE (ORIFICE CORRECTION		572	HOT BOX NO.	NO. 4
	TEST UNIT	NIT 572	Thex HOT	SIDE	TEST NO.	N-59	-MMS-	-728	METER C	METER CORRECTION	_[12707	COLD BOX NO	. NO. 4
	PROJECT NO.	T NO. 9	Ĭ,			(SIZE, f)	0.192		CALIBRA	CALIBRATION DATE	07-5	2-95	PROBE NO.	5-3
	CONTR	OL BOX C		3		PRESSURE	1.8.4	0.77	PITOT CO	PITOT CORRECTION		74	FILTER NO.	. UNINGLENGA
	BAROM	BAROMETRIC PRESSURE		38.00	PORT DIR	IRECTION	180	8	CONTROL	CONTROL BOX NO.	10/10/6		STACK DIA	•
	Traverse	- ine	Dry Gas	Pitot A P	δ	Orifice A H	Meter Te	mperature	Vacem	Sect	- Gara	Impiager	Hot Box	Consistante
			Meter Reading	(e. H20)	Req 'd. (in. H20)	Ad. (is. H20)	* E	8 5	(je. H.c.	į	1 5 5	Temp.	Temp.	
	23/	200	4/6555	7	98	88	122	1/2/	しい	1	2000	110 50	<u> </u>	27 12
				4,	86	86'	127	<i>K</i> //	7,7	├-				Service Property
				77	38	86	128	115/	6.0	160				T3 candre
				Q	.82	.82	128	1/5/	09	160				
				0./	82	. 82	128	9//	0.7	160				
				2-1	86	86	189	2//	6.0	762				
	19.3			77	86	86	129	<i>L//</i>	09	42				
				/ /	.10	O6.	/30	117	2:6	282				
				7.7	.90	96.	130	11	2:5	282				
			-	77	\ \oldsymbol{o}'\	90	13/	117	35	260				•
				1.1	06'	06	130	8//	5.5	291				
				1''	06.	90	131	111	5.5	22				
	8.5			80	67	107	(3	11.7	45	180				
				. 90	75	75	130	117	5:0	38/				•
				-90	36.	.75	129	8//	50	3%				Estimates:
				.90	25	.75	129	118	2	8				MW-29./
				90	175	77	130	108	5.5	280				SH20-9.0
		12:28	361.194	06'	29	.67	130	118	5.0	291				
- '	SYSTEM	LEAK CHECK	ECK		PITOT LEAK	K CHECK			Impinger	Inpiage	h			
		Vectoria	DOM RALE			Positive	Negative	,	Š	Contents	9	E.	Initial	Difference
		(is. Hg)	(cfn)		Before				-					•
	Before				ABer				2					
	After					-	7		-					
子なり	1	150 m	90 min	•	g	15.0	1		4					
*		ו שמנו	111 ME = 4.880 det	なな	8	7.0			~			,	7	
47/4		1997	1.05		3 5	CiR				Ž	relocaty =	40101	7	Z GVCTONE
	AQE 2/92	1 TO 1	AGE 200 CAPING		1	Tuke Jan = 1926		111	2.16 = (174		1/ 1/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2/2	186.5%		いっていること
_		7.(77)	141) - + 0.85		J	3 . 3/4/		(Jean)	\$ 1			,]	

			_		. l	STACK	C SAMP		STACK SAMPLING DATA SHEET	DATA SHEET	Ì	, C	Pag HOT BOX NO	Page 3 of 4
•	CLIENT &	SATIBLE	100 DOR	10.186	TEST NO.	1 110	- WAS - 72	J∼	METER C	METER CORRECTION		2 6	COLD BOX NO.	NO.
	PROJEC	T NO.	930028	1 -	NOZZLE ((SIZE, P)	0.192		CALIBRA	CALIBRATION DATE	0	2-93	PROBE NO	5:3
•	CONTRC	JC BOX C	1 1	Z.	STATIC PI	PRESSURE	1.07-	640	PITOT CO	PITOT CORRECTION	d	0.8%	FILTER NO.	3
•	BAROM	ETRIC PR	BAROMETRIC PRESSURE 28	9,	PORT DIR	RECTION	200	J	CONIKOL	CONTROL BOX NO.	THEE	11	SIACE DI	.
_	Touvelle	Tide	Dry Ge	Pact A.P.		HT verifies	Moter Ter	abataque.	Vacaem	_	402	Impinger	Hot Box	Commends
	1		Meter Reading	1000	Req'd.	Ad	ع <u>و</u>	3 6	(F. Hg.)	į.	Į.	7 (- C/-F)	į	
	707	122	1/1	/20	1_	50,	123	17	6.5	7	450°	481 6	10000	30mm /pT
	77.7	7	7	,		00,	128	8/	ر 0.	291			•	Spin Rollings
				(2)	00/	000	13/	8//	Γ_{-}	293				1 1
				۲.)	00,	80.	13/	2/	J	294				
				1.3	1.0%	30.7	132	8//	7.0	168				
					80%	1.08	132	8//	20.7	160				\
	707				2%	92	/52	611	6.5	7.60				
				,	32	.92	133	6//	しっ	46E			·	
				/ /	92	28	153	6//	65	295				
				//	92	.92	133	8 //	6.5	568				-
		_		/ /	22	25	133	120	6.5	295				
				17	2.	Ġ	133	100	6.5	296				
	\$ \frac{1}{2}			0./	.93	€8:	133	121	0.9	295				
	•			90	75	.75	133	120	0.9	386				·
				26	.25	34.	133	(3/	0,9	295				Estimates:
				96	74,	75	133	120	6.0	295				MW= 27.1
				0.7	53.	: 83	133	/0/	6.5	395				XH20-47.0
		14.03	510.20	0.7	23	86	183	/5/	67	295				
-	SYSTEM	SYSTEM LEAK CHECK	ECK		PITOT LEA	EAK CHECK			Impinger	Impieger		ì		i i
		Vacuum	DOM Rate			Positive	Negative		Š	Contents		1		Dulcrate
		(F. Hg.)	(cfm)		Before				- -	•				
	Before				Affer]		•					
	AA					- 3	7		, ·					
Page /	, <u> </u>	THE - Jan	John Mol	£0.	3 8	200			5					
	7	aunt.	raune + 11, to		8	0		-		which = 70, 9 Affect	20,9	Free	الما	7
बुब	406 3/89	多多	O)11 = 34/86) (40)	7	£ /	70,00	1	大百一一山	49	1000 A	* X X		¥!	KEYSIONE
		INM	1141 = 0.92	シ	27/20	197/		AC 1 × 1	-	1.04	, 0.4	0	J	1

				•	•	STAC	STACK SAMPLING DATA SHEET	LING	DATA S	HEET			ĺ	Page 4 of
	CLIENT	CLIENT BATTALLS	100 / NOF	•	TEST DATE		07-28-93		ORIFICE	ORIFICE CORRECTION		572	HOT BOX NO.	ło. 4/
	TEST U	NT S.C.	Kol	21.00	TEST NO.	14	-รัพนั	884-	METER C	METER CORRECTION		111	COLD BOX NO	4
	PROJECT NO.	NO. 9	2 Z	90	STATIC P	PRESSURE	1	477	PITOT CO	PITOT CORRECTION]0	24-50	FILTER NO	FILTER NO. 17, 25, 25
	BAROM	ETRIC PI	BAROMETRIC PRESSURE Z	28 96		IRECTION	Poet	4	CONTRO	CONTROL BOX NO.	1'	EC	STACK DIA	. 13.2
	Traverse	Time	Dry Que	Pitot A P	ð	Orifice A H	Moter Te	}	Vacuem	Steek	Probe	Impieger	Hot Box	Comments
	2 (Mater Reading	(E. H20)	Req 4. (is. H20)	Ad	a €	\$ 6	(F. Hg)	įe	10	(C. F.)	Temp.	
—	182	60.11	5/0.820	6/	1.09	40%	681	8//	2.0	295	2000	Klode hom		3000/05
				4	/.00	S .	132	18/	2.0	295				Resones
				7	80/	1,00	781	121	07	1225				Gran Smin
				ď	00.	7.00	16%	121	7.0	225				
				4	1.00	1.00	461	121	2.6	295				
				6.2	1.00	00"	181	121	02	225				
	C.61	11.39		7.7	/.00	1.00	134	/4/	2.0	295				
		*		7.7	1.0	01	735	181	20	29.5				
				7	1.0	0.7	135	181	2.0	29.5				
				7.7	0./	7.0	135	141	7.0	22.5				•
				1.2	1.0	0.7	130	123	7.0	195				
				1.3	0.7	0.7	150	122	7.0	225				
	8.5	15.09		4.0	19.3	68	135	122	6.5	29.5				
				0.1	83	183	135	(23	6.5	22.4				
		<u>.</u>		07	. 83	183	135	122	6.5	395			٠٠٠.	Estimates:
				07	83	€8:	135	122	6.5	794				MW= 29.1
				08	.75	.75	135	121	<u>ه</u>	294				*H20- 9.0
		15:39	560.860	<i>6</i> 6	عر ا	72	134	123	60	28				
•	SYSTEM	LEAK CHECK	IECK		PITOT LEAK	K CHECK			Impinger	Impinger	Ē			
		Vacues	DOM Rate			Positive	Negative	•	Ž O	Contont		Fine	Initial	Difference
		(in Hg)	(ctn)		Before			•	-					
	Before				After				7.					
•	Aher					-	1		'n					
ر. 2	DMC	ME = 90,	معدن		700	0:51		<u></u> . £	•					
Z Z	7 (2)		and the said	,	g	20			3					
10	3	٠ - ا ا			8 5	0 2			Kulow	4=729	7 5°C	É	لم	(
	AGE 2005	18/AF	NOE 20/AP/AC = (1(0)		7.7		1284	•	13	1-93.59	53.		2!	KEYSIONE
ز	$\Big $	1 A 13-1. r.	1200 = "			ير بدو		۽ رورن]	

€ 5 9). 	\ ·		Comments									hut down	wred Pic	するかけ	TART				Estimates:	/-	%H2O-		;	Difference						KEYSTONE
Page	HOT BOX NO.	COLD BOX NO	PKOBE NO.	Partia STACK DIA.	Hot Box	Temp.				,			/	0	75	\$					Esti	MW-	H%] /			Lakin					7-7	KEY
	82	ব	-13	i.	Impiager	Temp.	(f)	00)	5.5	24	64	53	ļ	53			75	52	15	15	52	5.2	75	5,5	,	Fire Control						
		ġı	NIE 4-16-	0. P. 2	Pobe	Temp.	1																		Impiager	Contents						
STACK SAMPLING DATA SHEET	ORIFICE CORRECTION	METER CORRECTION	CALIBRA HOR DATE	CONTROL BOX NO.	Seck	- E	-		,																· ·	පි			+	-		
DATA	ORIFIC	METE	CALIB	CONT	Vecum		0)	2	5	احد	၁	૭													Impiages	ğ	-	•	4	*		
PLING		728			Temporature	3 5	B	103	<u>ال</u>	1061	112	114		411			901	£01	111	211	स्या	118	811	911								
K SAM	8-93	- MMS -	1		Motor T	a (104	119	125	129	130	132		451			109	المها	571	181	58	36	136	132		Negative],	•			
STAC	EF-2	N-58	NOCCLE (SIZE, I)	ECTION	Orifice A H	Act. (in. H20)	2.0	2,0	ど	7.1	7 ' (2.1		7-1			2-1	1.7	7.	2-	2-1	2-(7	7、1	121	Positive		-	•			
	TEST DAT	TEST NO	NOCCLE O	PORT DIRECTION	ŏ	Raq'd. (is. H20)	20,0	2.C	2-0	ત્યું	12	2-1		7.)			7.7	7.1	2.1	2.1	2.1	2-	7,1	2.1	PITOT LEA		Before	And	263	00	8	£
			נ	1 2 2 2 3 3 3 3 3 3	Pitot A P	(in H20)																_	_							-		_
	CLIENT SHE TO E		PROJECT NO. 45-(018	$\frac{1}{2}$	Dry Gee	Mater Reading (def)	7810 140		263.2	<u> </u>	870.1	828.7		832.07		1	833.071	341.3	856.3		868.2	7.9148	3.24.6	862.8	ж	DOM Rate	(c(m)	20.00	710.0			
•	्रेसिट हि	VIT S.E.	90.5	ETRIC PR	Time		0000		0250		9460	0350	944	26.57		本	1020	0201	0h())	1050	1100	1110	1720	_	l # i	Vacuent	E. H	→	7			
	CLIENT	TEST U	PROJEC	BAROM	Traverse	Point (sechas))																		SYSTEM				ARIO			-

	(STAC	K SAM	STACK SAMPLING DATA SHEET	DATA !	SHEET				Page 2 of 3
CLIENT	CLIENT BAHRLLA	le DOE		TEST DAT	TE 7-28-93	8-63		ORIFICE	ORIFICE CORRECTION	~	128.	HOT BOX NO.	NO.
TEST U	INIT SE			TEST NO.		3-m15	-728	METER C	METER CORRECTION	, 9 N	6/18	COLD BOX NO	K 160.
PROJEC	7 NO.93	PROJECT NO. 95102 8		NOZZLE		(CALIBRA	CALIBRATION DATE	1	16-0	PROBE NO.	()
CONTR	OL BOX C		Back	STATICE	STATIC PRESSURE			PITOT CC			1 1	FILTER NO.	0.
BARON	METRIC PR	BAROMETRIC PRESSURE & 8.90	96	PORT DIRECTION	ECTION			CONTRO	ġ	Rex 2	`]	TEX-H-STACK DIA	A
Traverse	Time	Dry Om	Pitot A P	δ	Orifice 4 H	Motor T.	H	Vacous	No.	ž E	Inpiager	Hot Box	Comments
<u>ş</u> ş		Moter Reading (dcf)	(is. H2O)	Req'd. (in. H20)	Ad (e. H20)	다.)	3 6	(je. Hg)	įE	į£	Temp.	E E	
1	Ohli	901.10		7.7	7:-	\$21	120	e			5,3	1	
	0.51			7:1	2.1	/38	17	2		_	2	_	
	1200	918.7		1,7	2.(138	מל	3			\$ 2		
7	4	22.54						و			3		Pana V
	477												
1230	4	923.532		2.1	2-1	الكا	[16]	(۲			\$		SLART
	1230	h. 28p		7.1	2.1			9			5,7		
	27.0	940.8		2.1	7-1	196	130	8			1,5		
-	257	9.846		7.	2.1	281	05)	7			2		
-		458.2		2.	7	<u>~</u>	121	9			22		
_	0/2/	5.976		7	2.1	\$\)	17	J			53		
	1320	7:546		J-7	7	1,5,1	77	و		_	5.3		
	1335	न्धिप.।		7.1	7-1	2 H1	72	7			23		
	1340	9.2pg		2.1	1-6	142	1251	9		-	5.5		•
-	9561	2700		1 2	1.2	Ehl	(7)	و			()		Estimates:
	0071	١		117	17	chi	(25	7			2.5		MW-
	014	017.5		21	7.2	142	ってし	າ			23		%H20-
-	(42C	2. tx0	,	2.	2.1	143	125	و	-		63		
YSTEM	SYSTEM LEAK CHECK	SCK	- L	PITOT LEA				Impiafice	Impieter			<u>_</u>	
	Vactoria	DOM Rate			Positive	Negative		No.	Contents		Fish	Pairie	Difference
	E E	(c(u)		Before	1			- •					•
e jos			_	Aller				7					
Aler A			_	3	-	7	J	ń					
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A0E 232				Z			•					K	KEYSTONE
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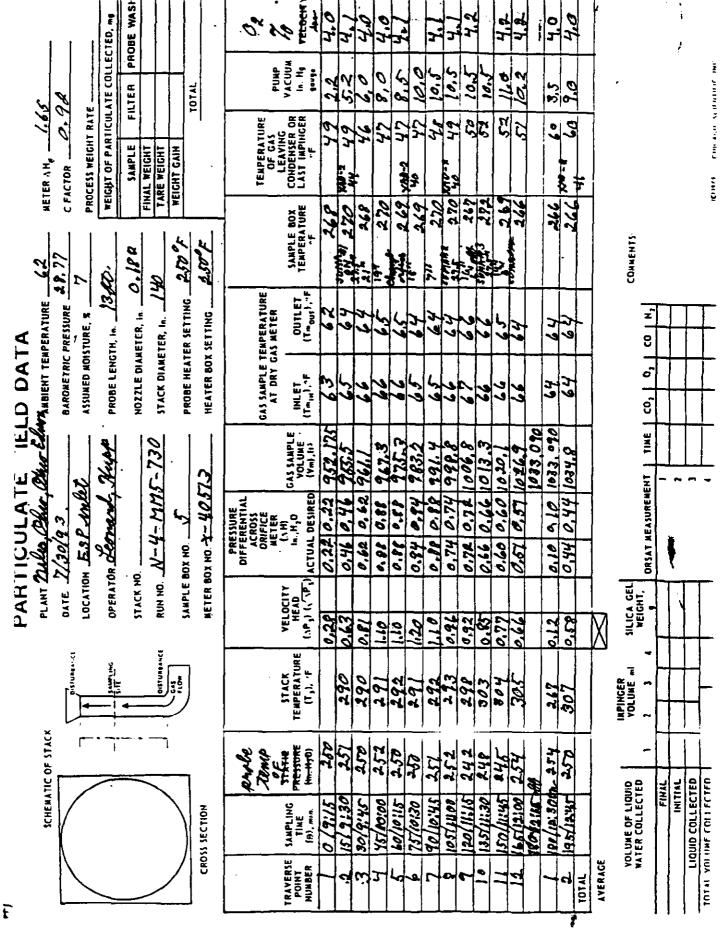
% jo €					Constituents	•															ies:		1		•	Unicano		<u> </u>	<u> </u>	T	7			
Page Sof	Ş	ا اع		ال	ď																Estimates:	MW-	%H20=		į							7	KEY?	
	HOT BOX NO.	COLD BOX NO	FILTER NO.	Partie JSTACK DIA	Hot Box	Temp.				-		-			_									-		(Marie]	نها	النج	
	\neg	9449	c) _0)	- Kir-112"	Impinger	CC-F	5,7	~>	~	23	4 FS	53	~												i	Fire								
_	- 4	d)	1	CONTROL BOX NO. Pour 2	Probe	<u>.</u>													-	-					lmpinger	Contents		•						
HEET	ORREC	RRECT	RECT	BOX	Stack	, E		-	+	ļ_					_	_	-	-	\vdash	-	-	-	-		Ē	ខ								
STACK SAMPLING DATA SHEET	ORIFICE CORRECTION	METER CORRECTION	PITOT CORRECTION	CONTROL	Vector	£	,		3 1) 9	9	5	9)												Impiager	Š	-	2.	'n	4	\$.			
FING		826-			mporeture	1	125	101	2 2	120	23	471	127																				_	
K SAMI	8-93	ZMM-	ì		Moter Ten	<u> 1</u>	77	١.	77	143	hhi	hh)	140													Negative			1					
STAC	压子	N-58	PRESSURE	RECTION	rifice A H	Act	-	17	- - -		7.7	2.1	ابز												AK CHECK	Positive			-					
	TEST DA'		STATIC P	PORT DIR	ဂ	Red'd.	n non	1,	1-7	7 - 7		17	2.1												PITOT LE/		Before	After		C02	70	8	K 2	
٠			4	9	1 🖳		E HZO	\	+	1		-	-			1	-	-	1	-		-		-						1				
	200 J		PROJECT NO. 15 - (02 g	BAROMETRIC PRESSURE 2 &	Dry Que	Mater Reading		d	77.7	224:7	7 7 7 7 7 7 7 7 7		X 780	٦,	1					ļ					SCK.	DOM Rate	(c(s)							
	Rethe	П 50	NO.	TRIC PR	Time		100	丁		250	22,00	36.4		T	T										LEAK CHECK	Vecuun	(in. He)							
	CLIENT	TEST UNIT SO	PROJECT	BAROME	Transfer	Point	(i)	+		+				-							-				SYSTEM 1			Pefore	AA.				AQE 2/92	

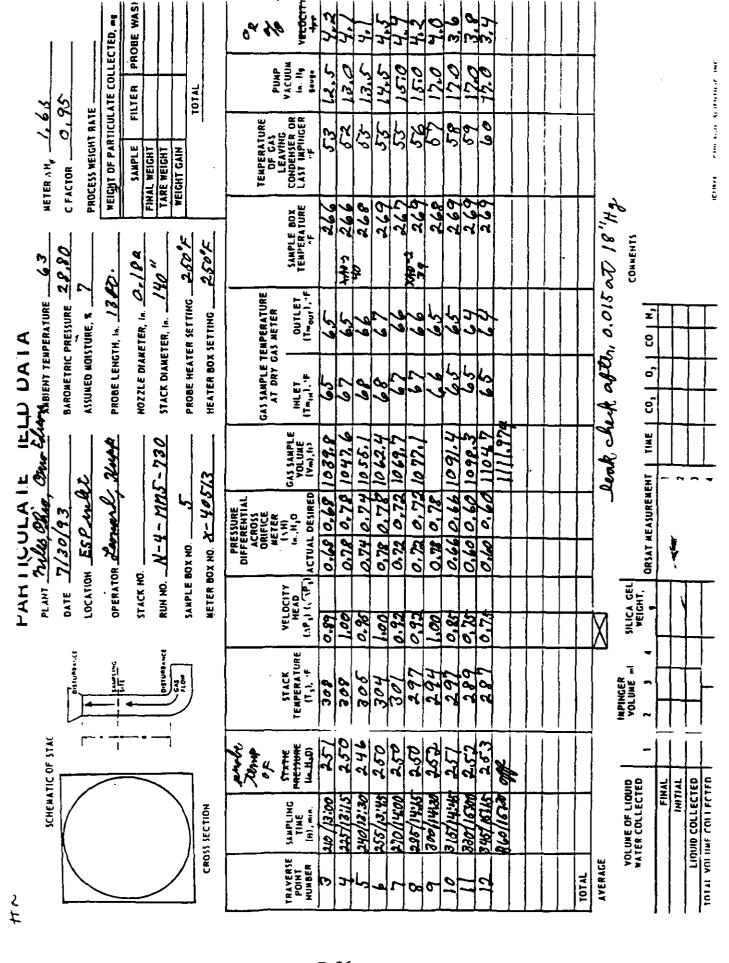
PLANT riles Oliv Oliv Edison	
DATE 7/30/93	
SAMPLING LOCATION ESP inlet	_
N-4-MN5-730	

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ 0	ΔH _e	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	T _{m avg.}	90
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B _{WO}	7
BAROMETRIC PRESSURE AT METER, in. Hg	Pm	28.77
STATIC PRESSURE IN STACK, in. Hg		
(Pm±0.073 x STACK GAUGE PRESSURE in in. H2O)	Ps	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P ₃ /P ₈₁	1.0
AVERAGE STACK TEMPERATURE, °F	T _{Savg.}	310
AVERAGE VELOCITY HEAD, in. H ₂ O	Δp _{avg} .	0.85
MAXIMUM VELOCITY HEAD, in. H ₂ O	Δp _{max.}	
C FACTOR		0,92
CALCULATED NOZZLE DIAMETER, in.	0.2	38
ACTUAL NOZZLE DIAMETER, in.	0.14	2
REFERENCE Δρ. in. H ₂ O	2,	40

EPA (Dur) 234 4/72

Checked by:





ACK SAMPLING DATA SHEET 2. 3.0.73 (Tr.) ORNIFICE CORRECTION	
TION 572 TION 0.573 ON 0.237 ON 0.237 ON 0.237 Temp. ("P) ("C"F) ("P) ("C"F) ("C	
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THON OON THE STATE OF THE STATE	
MPLING DATA SHEET 15 - 750 METER CORRECT 27	
MPLING DATA S MPLING DATA 15 15 15 15 15 15 15 15 15 1	
MPLING	
Z ZZ MINE CCZ JOSE ZO J J J Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	
CK SAM	
TEST DATE 027 TEST NO. N 5-6 NOZZLE (SIZE, P) STATIC PRESSURE Reg 4. And	
2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	
1000 1000 1000 1000 1000 1000 1000 100	•
CLIENT SATISMET TO STAND TO ST	(

						STAC	K SAMI	STACK SAMPLING DATA SHEET	SATAS	HEET				Page 2 of 4/
3	CLIENT	BATTELL	100/		TEST DAT	TE 07-3	07-30-93 (M.		ORIFICE (ORIFICE CORRECTION	1.572	72	HOT BOX NO.	NO. 4/
	TEST UNIT	T 5775.X		2,00	TEST NO.	P. N54	5WW-	73	METER O	CASTER CORRECTION	370-7	120	COLD BOX NO	. NO. 4
E S	PROJECT NO.	. BOX 0	PROJECT NO. 4320 28 0 CONTROL BOX OPERATOR A	100	STATIC P	tra :	0. (7-	140	PITOT CO	PITOT CORRECTION	2000	3	FILTER NO.	. WW. CHE
BA	ROME	BAROMETRIC PRESSURE	ESSURE 28	12	PORT DIR	RECTION	Rock	8	CONTROL BOX NO.	BOX NO.	THREE		STACK DIA	1. 132"
	Traverse	Time	Dry Gee	Pitot a P	Ö	Orifice A H	Meter To	Н	Vacuum	_		rabinger	Hot Box	Constitution
	j j		Mater Reading	(ii. H20)	Reg'd. (in. H20)	Act. (b. H20)	4 (F)	¥ (£)	F. H.	į£	(-F)	Temp. (*C/*F)	Tong. (*F)	
20	j	10:43	78026	77	38	26	1001	66	15	28/1€	وغر	Wr 5.20	7 252	30 min 107
1	+		7	12	ځ	8	110	98	SS	46€			,	Sam / Keasing
				12	96	98	//3	86	5.5	386				
<u> </u>				7	86	86	//3	86	8.8	284				
<u> </u>				7.7	86'	86'	8//	86	يخك	296				
				47	86	86.	7/3	66	5.5	289				
	2 %)	۲%	82	211	46	0-5	7280				
]_	1			O	47	. 82	7/1	16	0-3	286				
				5	2	82	1/3	66	0:5	285				
				0/	83.	78.	/دع	86	5:0	283				•
				3.	. 22	7	112	99	5.0	200				
<u> </u>	 			8	273	20	E11	98	5.0	286				
<u> </u>	8			50	99	00.	///	99	45	279				
	1			3	90	00	///	98	4.5	283				
				U.S.	99	90).	111	98	4.5	283				Estimates:
_				08	99.	99.	711	48	4.5	282	_			MW- 29.6
				S	9 9.	.66	//2	98	757	202				%H20- 7.0
_		212	327.830	180	.66	. 66	///	Z	4.5	283				
SYS	TEN	SYSTEM LEAK CHECK	Ä		PITOT LEA	AK CHECK			lapinger	Impiege		1	la:si-al	Piffermere
		Vacuem	DOM Rue			Positive	Negative		Ž	Company				
	-+	G. Hg	(c(m)		Before									
4	Before				Affer]-],		•					
ال	ASer .	9		_	600	14			-					
وعلق	35	1201 B	# 5KY	Tot.	20	6:0			۶.		!			
7.#	> 2,	11 しっ き	www.c= 46.75 c)	8	0				whork	ロール	= (7.3 A/Lec	ار بر	7
toled	ب !	47/AG	001) = 24/A)	•	22	7115	- 1	-	,	2	1-95.17	(7,	Y !	EYSTONE
-	E 2742	(AH)	1AH Jan =0.82	L	T. L. 1.	1 156	7 (Towns)	= 28(In	Ar = 285%		2)	ر	,

					STACK	SAMPI		STACK SAMPLING DATA SHEET	IEET			Pag HOT BOX NO.	Page 3 of 4
CLIENT ANTIBLES	194734 F	173,26 100c		⊢ 1 .	17	59-30-93 (11.		METER CO	METER CORRECTION			COLD BOX NO	NO. 4
PROJECT	NO. 2	VIOR A	100	NOZZLE (SIZE,) STATIC PRESSURE	9 1	١٠,	2.11.0	PITOT CORRECTION CONTROL BOX NO.	RECTION BOX NO.	1 Marie		FILTER NO.	FILTER NO CHURS STASS
BAROMETRIC PRESSURE	TRIC PR	7	8.8	POKI DIKECIJON	11	Hore I		Vacous	ll -	Probe	Impinger	Hot Box	Constronts
Traverse	. <u>\$</u>	Dry Gee	4 1014	Ž	Adt.	=	ō			Temp.	Temp.	Temp.	
			(in. H2O)	_	E 120)	וים	3	2 2	╁╌	7.4	(108, ED.)	3000	10/200
1/8	71.7	827.330	12	88	77	603	200	1	X,	Т			1/8
			1.2	93	26.		200	2	000				3
			1.00	86	22	# # # # # # # # # # # # # # # # # # # #	200	ė,	287				
			77	-93	D	7/	38	0.9	2/2				
			12	86	86.	18	98	0.0	200				
			77	86	2	(//2	9%	6.0	287				
2 p.			7	× ×	62	110	- 66	V	232	+			
7.			× 0	78	cd'	///	99	5.5	180	1			
				2%	08	4)/	86	0	386	1			
			,	06	Ca	1~	66	0	282				
		·		.8.	S	+-	66		280				
			3	2	2	1/2	48	45	1820				
- 11			2/0	20	100	7/	98	5.5	285				
2.0			-70	7	120	6//	66	کنک	alle				
			J _e	200	200	1	96	58	280				21
			ز ام	٥ ((28	1/1	00	5,5	160				2
			7		100		0	15.7	180				8H20- 9.0
		100/100	30	30	10	///	66	25	385				
	12.47	5.478/61/2	,,	- 1 1	AF CHECK			Impieger	Impinger	*		•	į
SYSTEM	SYSTEM LEAK CHECK	IECK				Negative		S	Contratt		Tine.		Difference
	Vacuum			Before				-					
	8 2 2			ş				7					
					_	1		ň					
	1	40.00	-	203	14.5			•]					
F >			det.	8 8	6.0			ń	10/2/		1908/1	7	7
	(44)	(AP) = 1.05		1 1	75.5			ģ	3		67-		KEYSTONE
X-10.2. AQE 2.92	444/	104 hr = 0.87	~	Tropy 2	140 = 108°F	_	et he	ISAK AR = 2801	3	. 1.61 = .		J	1

		,				STAC	STACK SAMPLING DATA SHEET	PLING	DATA S	SHEET				Pogs 4/01 4/
5	CLIENT	BATT6146	700 mor		TEST DA	ATE 02-	02-30-93 (M	(£i.)	ORIFICE	CORRECT	8/5	7.7	HOT BOX NO.	NO. 4
# f	TEST UNIT <	TEST UNIT STACK	CK - NOT	3,06	TEST NO.	0. N-Sa	7WW-	750	METER C	METER CORRECTION	$ \cdot $	13	COLD BOX NO	K NO. 4
£ 8	STATE OF THE PARTY		CONTROL NO. 73C 02C		MOZZEE	(SIZE, F)	757	11111		PHOT CONFERENCE	9	2-95	PROBE NO.	1.57.3
≨¦ک	ROME	TRICPR	BAROMETRIC PRESSURE	10		RECTION	الأوالة	200	CONTROL	CONTROL BOX NO	0.84		CTACK DIA	コ
	Traverse	Tine	113	Pitot A P		My wifee	Meter Ten	emocratura	Vest	1000	1	1	He be	
	Pois E	_ -	Moter Reading	(J. H.20)	Reg'd.	Act.	<u>a</u> (4	0 5	3	,	To a	Temp.	Temp	
<u>1'</u>	1~	12.00	27/	,	00	00		100		700			_	
1	7	7.7	_	ر ارج	,,,	0/:	20/	^ 0	9	, C \$	7252	100 PO.	2000	Dais/Per
		<u> </u>		6	<u> </u>	- 98	20	^ ^	0	282			ŕ	Pagains
				(Z)	\$6.	98	109	. 16	6.0	120				Guer Sair
				1.2	. 98	. 38	///	9.9	6.0	280				
				12	.98	88	///	98	0.0	280				
				12	98	98	///	99	0.0	086				May 18 5 / 1 / 10 /
	1234	1427	895.275	1/	.90	90	11.1	9.8	5.5	68C				7 4864
		1423	-320 St.	1.1	.90	.90	///	99	5.5	28%				Charles a
				1-1	90	26,	0//	99	5.5	287				1
				//	.90	90	112	8 6	5.5	186				•
				17	90	90	1.2	99	23	242				
:				/ /	.90	90	7/1	66	تخزر	286				
7	23	ļ		.95	32.	32	///	99	6.0	291				
				.95	20	82.	1)))	88	5-0	390				•
				95	.78	. 28	///	18	320	295				Estimetes:
				95	82	35	111	98	5.0	295				MW- 286
_]		45.51		B	78	27.	////	90	8,0	248				8H20-90
	7	15.20	456-184	7	.79	36.	///	88	5.0	296				
SYS	SYSTEM L	LEAK CHECK			PITOT LEAK	C CHECK			Impinger	Impiaget	12.			
		Vacuum	DOM Rate			Positive	Negative	•	Ş.	Contracts	Į.	F.	Initial	Difference
	-	(is. Hg)	(cfm)		Before				-					
2	Before				After				7		•			
	ASer					-	7		ď					
1 80 80	TIME =	0" '''	Ornen		203	14.5		!	÷					
	3	TANCE OF	72 49,009 45	<u>t</u>	8	60			2					
<u> </u>	-			!	2 3	300				75	Lebach =	49.04	See 2	
April Age	m	AGE IM BP /AK =		→		Ś			25.28	B	٠.	- 34.99°	ZI.	EYSIONE
	•	raction	800	J	(142/KB	\$ "Br		1941/48 = 101 F	107	1		•	j	
						I			I					

X.	ZXZ	KEYSTONE			STACE	SAMPL	STACK SAMPLING DATA SHEET	SHEET				73	
	Nibs a	Ohio	DATE	7	30-	93	HØ	AMP: 1.82	17		HOT BOX NO.	X NO.:	
LOCATION:				TEST NO.: N	N-5B-MM5-730	105-3	ı	METER CORRECTION:	•	2,965	0,9649 care box no	OX NO.	1
ACTIVITY NO:	1	707-26	می	15:			=	PITOT CORRECTION:	CT10N:		PROBE NO.:	₩.:	
CONTROL	80X OP	ERATOR D.	Stan	IC PRES	SURE Ps:		8	HTROL BOX	19. : B	अर निक	CONTROL BOX NO.: Bex 2 FILTER NO.	NO.:	
PROBE HANDLER	WIDLER		P007	PORT DIRECTION:			1	NONOGRAPH SET POINT:	ET POINT		STACK DIA.:	DIA.:	,
CLEAN UP			BARO	METAIC :	BARCHETAIC PRESSURE	58.93	1	LENGTHS OF UMBILICAL	UMBILICA	11	× 25°	. 88 ×	• ·
		Neter				Heter Temp.	emp	Vacuum	Stack	0	1	Ho Box	
9	1	Kead:ng (dry)	•	1n. H20	H20 PH		1	# c 2			Temo.	Temp.	Comments
1	Y N	1111 72J	III. 1120	7.0	1.0	90	89	\script{\sinte\sinte\sint\sint\sint\sint\sint\sint\sint\sint	1	+	<i>[a]</i>		
	7/80	470.6		22	2.0	200	8	11.0			56		
	75.60	720 5		2.4	かで	401	9	11.0		\	75		
	97	438.6		7	かて	111	76	140			49		
	17.89	1447,3		7.4	ካ " ሪ	113	to	0.11			48		
	6755	45/0-1		7.6	7.6	115	99	11-6			48		
	500	100		2.1	7,0	116	101	1140			47	_	
	101	8 24.1		7.7	カで	117	(0)	1.4.5			47		
_	170	1 7	-	7.4	って	611	7 O	10.5			43		
	75	191, 10	-	7.4	2.4	117	K)3	10.5			五	-	
5	U	500.8		24	24	811	10.7	7.7		-	97	1	
×5.	人子作			70	2.4	113	103	10.5			40		
10		5/3		770	2,4	113	103	10.5		1	43	-	
Ě	Z F F	7578.2		2.4	2.4	118	103	10.5		1	48	1	
	1125	1		7.1	2.4	113	103	5 6			43		
	1.35	0. Pt. S		hit.	2.4	711	1013	10.5			1/10	1	
	1	₹	ORSAT				=	Impinger No.		Fich	13	TWINK BITTERENCE	rence
LEA	×	27.	-[r		i						
1	5 Kg	Hate 03	 	+			I	4~					
Before	15	0.00× G			_		I 1	1				\ 	
After	,,			-	<u> </u>		1	4					
	え	1 Km-0			, I								

X	EYST	ONE			STAC	K SAMPL	STACK SAMPLING DATA SHEET	SHEET				2/3	W
	PLANT: Miles.	ીમે.	DATE:	7	30-93	~	AA	AHD:	1. 321		HOT BOX NO. :	X NO.:	(
LOCATION:	ä		ON TEST NO		N-5B	- MMS	-330ME	N-SB-MMS-330METER CORRECTION:		0.961	0. 9649 care box no	0x NO.:	
ACTIVIT	T NO: 6	ACTIVITY NO: 92 028	M022LE:	.:			ā	PITOT CORRECTION:	1		PROBE NO. :	NO.:	I
CONTROL	BOX 0P	CONTROL BOX OPERATOR DI BRAZE		STATIC PRESSURE	SURE Ps:		3	NTROL BOX	NO.: R	X Yar	CONTROL BOX NO.: Box 2 Re-1 land FILTER NO.:	¥0.:	1
PROBE HANDLER	WIDLER			PORT DIRECTION:	108:		2	MONOGRAPH SET POINT:	ET POINT		STACK DIA.:	DIA.:	
CLEAN UP	 		EARO)	BAROPE TRIC	PRESSURE	£ 28.93	1	LENGTHS OF UMBILICAL	UMBIL ICI	1	7 25°	3	•.
		Heter	2 - 2			Heter Temp.,	carp.	Vacuum	Stack				
40,00	1	(dry)	HO 100 10	5	H20	= u +		ē Ē	· .~	Teno.	- L	Temp.	
	Ĭ	2636	In. H2U	. Z	7 C	= <u>+</u>	200	# # # # # # # # # # # # # # # # # # #		9	17.27	# H1	Coments
	高が	562.to	\ \ \	7.4		116	102	10.5	\ \		84		
	1205	15.145		7-7	2.4	118	163	10:5			42		
	1215	580.2		7-6	ካ .ሮ	117	103	8-01			77		
	1225	587.2		2.4	2.4	17	103	VY VY			17		
	1235	577		2-4	アイ	स	[0]	(0-5			40		
	1245	5.005		7.7	7.4	17	103	5-17			140		
	1255	(015.F		2.4	7-4	117	103	ارک .0			1//		
_	1305	15. heg		7-4	ング	711	[03	(0, 5			[<i>h</i>]		
_	1315	16334		24	ታ.ሪ	117	[03	(u-5			36		
	122	コアフィウ		2.4	2.4	113	103	(0.5		•	38		
	1335	1 65/1.		24	7.4	113	103	10.5			139		
	1345	1060 2		ンペ	24	117	103	70.01	_		38		
	1355	1.169.1		24	2.4	11.0	103	10.5			23		
_							,			•		_	-
			ORSAT					Impinger No.		From	TWITIAK	A Difference	ence
- ונאו	LEAK CHECK	Date (0.	7	<u>م</u> ا	<u></u>		}	-					
┿~	+				 		1 1						
מומוב		9	i	1	-		ł	-				-	
After	_	_	-	. T	- -		ļ						

MO.: 73	Hot Box Temp.	Comments	Shutde	02		END			Difference
HOT BOX IN COLD BOX PROBE NO. FILTER NO. STACK BILL	Ing.	67		40	42	42			al Terifiak
_ ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	Stack Temp.			V.V.	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Ņ			r No. Poul
45-230	Heter Temp., Vacuum Tem Ven F in Out Ho	102		1 160 10.5	101	2.0			Impinger 2 3 3 4 4 4 5
선 기 기 등 급 등	Ortfice att the Had	アンドン	╌┼╌┤	74 24 M	24 24 16	╀═╀╌			
म् प्राप्ता	ing Velocity HD In Ho	24	SIS (358	7	34	-		00SAT
KEYSTONE PLANT: Mes Obio LOCATION: ACTIVITY NO: 95/02 8 CONTROL BOX OPERATOR D. PROBE HAIDLER CLEAN UP	Reading (dry)	77		1437 [ew.]	147 72	53 Mars 727			IN HY RATE
20 20 E E E E E E E E E E E E E E E E E	Point		22			5		1	Before

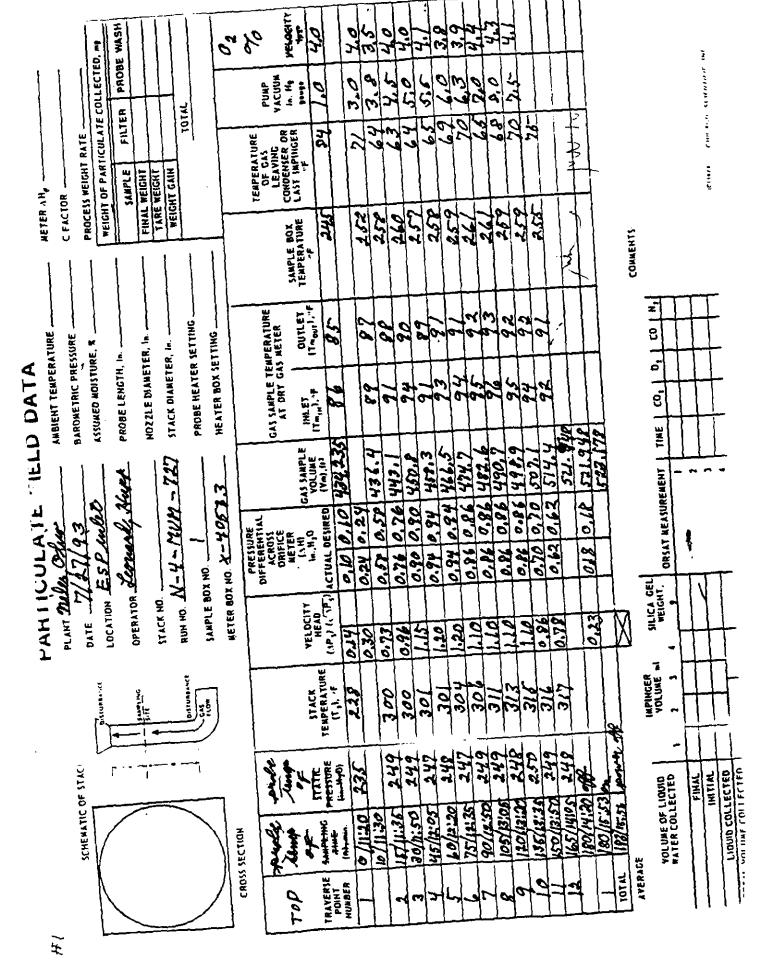
D-2: Multi-Metals (Method 29)

PLANT Niles Olivo Ohio Edwar
DATE 7/29/93
SAMPLING LOCATION ESP inlet
N-4-MUM-727

		<u> </u>
CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔH _Q	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	T _{mavg.}	110
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B _{wo}	7
BAROMETRIC PRESSURE AT METER, in, Hg	Pm	28.84
STATIC PRESSURE IN STACK, in. Hg (Pm±0.073 x STACK GAUGE PRESSURE in in. H ₂ O)	P	0,65
RATIO OF STATIC PRESSURE TO METER PRESSURE	Ps/Pm	1.0
AVERAGE STACK TEMPERATURE, °F	T _{savg.}	3/5
AVERAGE VELOCITY HEAD, in. H ₂ O	Δp _{ayg} .	0,80
MAXIMUM VELOCITY HEAD, in. H ₂ O	Δp _{max.}	0.96
C FACTOR	0	,95
CALCULATED NOZZLE DIAMETER, in.	0,24	10
ACTUAL NOZZLE DIAMETER, in.	0,18	2
REFERENCE Δp, in. H ₂ O	2.2	

EPA (Dur) 234 4/72

Checked	by:	
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					STACK	C SAMP	LING	FACK SAMPLING DATA SHEET	HEET				Page / of 水4	
CLIEN	I RATTEL	1 106		TEST DATE	TE 0 7-7	-23 (Two	\neg	ORIFICE CORRECTION	ORRECT		20	HOT BOX NO.	NO.	
TEST L	TEST UNIT STACK	/ HET	5,76	TEST NO. A/-	۲		727	METER CORRECTION CALIBRATION DATE	TION DA	ON 0.4434	34	PROBE NO. 4	I NO.	
PROJEC		7.2%	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	CTATIC PRESSIRE	E E	1.0.1	40	PITOT CORRECTION	RRECTIO	N 0. 27	7.	FILTER NO).	
T TON I	PAPAMETRIC PRESSURE	PESSINE 20	29.62	PORT DIRECT	ECTION	1.	9	CONTROL BOX NO. LARLY	BOX NO	. water!!	4 30 901	STACK DIA	A. 132 "	
		117	A Marie	16 11	Origos A H	Motor To	and a second	Vector	Stark	100	To see a	Hot Box	Comments	
2	<u> </u>	Meter Reading		Reg'd.		ج و ا	S E	F. H.	ţe	į	Temp.			
	19 E	20707		26/	(23)	66	286	3.0	28%	2050	(68° Pe	-Jase	Tolard	
3/1	1000	_	/ /	7,92	1,92	60	86	3.0	188			_	16.00 ing Sixter	
	-		,	192	1.92	66	86.	30	360				Smik	
			/:/	1.92	1.92	100	86	3.0	390					
			//	192	1.92	10/	26	3.0	1750					
	-		10	7,7	175	80/	26	3.0	290			_		
£ 6/				1,92	1.92	<i>a</i> //	93	30	160					
			0 /	1.75	1.75	9//	56	3.6	290					
	-		0.7	1.75	1.75	///	46	3.0	291					
111.2			7	1,1	14	///	46	3.0	210				•	
	-		₹ .	2,	1.92	///	196	3.0	290					
	-		1	66	60	C !!	15	10	889					
40	-		20	661	ره دو	//3	26	3.0	263					
۹ .			200	17.	18	(,)	3	3.0	383					
	_		277	13/	/2/	7/	46	12.5	289				Estimates:	
			3.4	1.3/	1.3/	113	76	2.5	390				\mathcal{C}	. <u></u>
3	-		5.75	13/	131	112	76	80	390				%H20- 9	
1	11.24	5411x	275	/.3/	181	11.2	%	20	1381					X
CVSTEL	7			PITOT LEAK	K CHECK		-	Impinger		Impieger	5.662	454.2	••	
	2	DOM Bare			Positive	Negative		9	DAY Conton	tonts	Find	Initial	Deflerence August	
	(i. H.)			Before	0 4/16 Gac	26/156		-	04 1001	24/00	0.850		7.5.4	2
Pelore	+	~	-	After	70/236	Maic		7	15001	20/60	direct.	1007	1000	40
Aher	16.5	<0.000			-[2	7	_	•		KALOS	7200	635.3	2,5	13
Te 7 21	THE - GOME) men.	7	8 8	000	600		5	T. T.	KANOL	61513	1014.3	07	7
	COUNTE 1	vaune = 67. 557 d	<u></u>	ප	O	0		ē.	Silice	ER	695,5	655	7,43.0	
ব্	(41)	8	'	Σ ,	100	740	- 61.	(Luke Jr. = 102°)	7,	rjer	4.46	15 46 K	EYSTONE	
AQE 24	28/32 z	AQE 2001 (AV/AIX - U. 1)		r-pas		06:11	1	:	プペッカト	3	1 6000 1	b / 600	\	

						STACE	C SAMP	LING	STACK SAMPLING DATA SHEET	HEET				Page 2 of 16 4
	CLIENT	BATTELLE	Le bor	٠	TEST DATE	9	-27-93 (Tues	(Tues)	ORIFICE (ORIFICE CORRECTION	7	20	HOT BOX NO.	to. ,
	TEST UP	NT ST	Hot	5,76	TEST NO. N -	٦	MUM -	127-	METER C	METER CORRECTION	9	6636	COLD BOX NO	NO.
	PROJEC	T NO. 9	ι	- 0	NOZZLE (SIZE,A)	0.228	2	CALIBRA	CALIBRATION DATE	.		PROBE NO.	6
	CONTRO	O XOO TC	PERATOR &	LPC	STATIC PR	PRESSURE	7.0	0 40	PITOT CO	PITOT CORRECTION	ó	4.	FILTER NO	
	BAROM	ETRIC PR	BAROMETRIC PRESSURE 29.00	00	PORT DIRECTION	ECTION	FORT		CONINC	CONTRUL BOX NO. LURE	11	10/04	SIACE DIA	150
	Traverse	Tires	Dry Ose	Pitot A P	O	Ordice A H	Moter Te	Temperature	Vacuum	Seck	Probe	Impinger	Hot Box	Comments
			Moter Reading	(jr. 1720)	Req'd. (in. H20)	Act.	1 (F)	ğ E	(F. Hg.	Tege Fig.	Temp (F)	1 (-1 (-1 (-1 (-1 (-1 (-1 (-1 (-1 (-1 (-	Temp (*F)	
	168	18:11	761.642	1.00	2.07	2.07	100/	26	35	280	1 %	187 Jan	~250 %	Dr. Jer
	1	1		1	2.09	209	CO	95	2.5	290				Rending
				7	747	2.27	10.7	35	35	290				aker Said
				1.30	2	227	107	95	3.5	290				
				3	2.27	2.27	1.5	96	35	391				
				1.40	44.00	7.44	///	95	35	891				
•	193			0/-/	1.92	1.93	116	96	3.0	292				
٦	1			0, '	661	687	117	96	3.0	160				
<u>.</u>				9//	261	1.92	10	26	9.0	1100				
				a/	192	1.82	411	26	5.0	160				•
	·			1.10	132	1.92	117	86	3.0	162				
				9/7	1.92	182	1//	9.88	3.0	291				
	2.8			01.1	761	1.92	1160	36	3.0	230				
				- 95	797	166	/ری	98	3.0	294				
				.95	77.7	1.66	115	98	30	295				
Ŷ	1			960	1.57	157	115	\$	2.0	294	İ			MW- 28. &
				.90	157	157	110	38	0.0	8				SH20- 7.0
		13.01	933.130	.90	ري ر	121	117	99	0.0	294				
	SYSTEM	LEAK CHECK	ECK		PITOT LEAK	к снеск			Impinger	Impinger	<u>5</u>	į	•	
		Vacrem	DOM Rate			Positive	Negativa		ş.	Contents	2	3	initial Initial	Difference
		(in. Hg)	(c(m)		Before									
	Before				After				7					
	Ş					-	2		3.					
- 2	4	JM61190MG	o mer		203	15.0			•					
3	\$	1	12 488 det		8	6.0			ń		777] !	
1		, T	0) / -		3 2	90			velouty	= 4.6+181C	+1850	, -	7	V EVSTONE
3		AGE UM (AP)/AKO - 1.	70		Tweether	1	7	,	ly.	(SIL)	(1=1) (SIL)	_		
1	۔ لــ	(3H)AR "	<u> </u>	,	15-42	3	292°F		; !	-	,			

					٠	STAC	K SAMI	PLING	STACK SAMPLING DATA SHEET	SHEET				Page S of	78/10
O	CLIENT	BATTE	BATTELLE DOE			DATE 02-87-93 (TOLA)	7-936	(830)	ORIFICE	ORIFICE CORRECTION	٦	1.650	HOT BOX NO.	NO.	.
ı— is	TEST UNIT	TEST UNIT CONCE	LE - HOT	5.76	TEST NO.	NO. W - S-9 - MUMS	MUMS	725	METER C	METER CORRECTION CALIBRATION DATE		0.9939	COLD BOX NO	X X0.	
- <u>`</u>	ONTRO	L BOX C	MTOR	200	STATIC P	C PRESSURE	1.0	1.0 140	PITOT CC	PITOT CORRECTION	0.04	he	FILTER NO	0.	
, Jee	AROME	TRIC PR	BAROMETRIC PRESSURE 29	29.00	PORT DIR	DIRECTION	PORT	Q	CONTRO	CONTROL BOX NO. AAJTGC. H.	ATECH .	# 55BM	STACK DIA	A. 132"	
<u>ٿ</u>	Traverse	Tise	Dry Gee	Pitot A P	5	Orifice A H	Meter Tes		Vectoria	Stack	Probe	Impiager	Hot Box	Common	ļ,
	3		Meter Reading	(j.	P. M. d.	Ad.	4 E	\$ E	6 He	įę	į	Temp.	, e		
1	0,0	12/3	933 / 30		1.82	192	86	8-7	V	7	2001	685 F	1	17.00	 -
1		-	4	1_	808], 2	66	62	3.0	16					Ane
1				1.6	2.09	<u>. </u>	0/6	86	3. C	299				San	
<u>ا۔ ۔۔</u>				(,0	175	1.75	1,11	86	2.5	399					
1_,				0 /	561	1.75	9//	00/	2.5	296					
T.	b.			0.7	1.75	54.1	5//	100	25	226					
	193			1.3	271	2.27	111	ea/	3.5	297					1
1				1.3	7.0.2	727	211	101	3.5	217					
				/.2	2.09	209	8//	/0/	3.0	287					
				1.2	209		811	101	3.0	296					
<u> </u>			ŀ	72	209		(/)	10/	13.0	262					
<u> </u>				-96.	608		811	102	3.0	780					ļ
!	8.8			.96	168	1.68	119	/03	3 C	298					
<u> </u>				.96	801	1.68	677	103	30	2%				·	
2	ł			26.	1.66	1.66	6//	103	30	297				Estimates:	
				(.0)	527	1.75	120	401	3.0	299		,		MW- 29	M
<u> </u>				90,	Sz 1	175	120	101	3 ()	388				XH20-	
		54141	903.275	0./	1.75	1.75	/20	104	9.0	218					
jés	SYSTEM	LEAK CHECK	IECK	ļ	PITOT LEAK	UK CHECK			lampinger	Impiager					
_		Vacuen	DOM Rate			Positive	Negative		Š.	Contents		.E	Page 1	Difference	_
		(in. Hg)	(cfm)		Before				-						
L	Pefore				After				7.	•					
!	A)er					-	1				Ì				
Rye C	THE -	THE = 90mg			6 0	15.0			•						
¥	. !	, i	in the det	+	8	ڊ ڏ			~]		
~	∄ ,) -	10 1 10 1 1 0 1 1 0 0 1 1 0 0 0 1 0		පි	200			relocity	whoch = 70.8 Heac	#se	,	ئيا	7	
	06 200 L	かなる	100 200 (A) (A) (A) (A) (A) (A)		4	= 108%	10.	_	ğ	-95.59 (Yal	<i>(</i> *) (<u>.</u>	٤!		0, Z:
_	`	1111	- 19n	4			101				2		١	1	

						STACI	K SAME	STACK SAMPLING DATA SHEET	SATAS	HEET				Page 4 of	of X 4
	CLIENT	CLIENT RATECLE	3001 JOSE		TEST DATE		102-12 - 15 (July)	_	ORIFICE CORRECTION	ORRECT	-	0	HOT BOX NO.	NO.	-
-	TEST UN	二十二	4 .	5,46	TEST NO.	2-50	- MUM		7 METER CORRECTION	ORRECTR	ON 0.9939	139	COLD BOX NO	. VO.	
•	PROJECT	TNO. 9	la	14	NOZZLE (E (SIZE,A) O	n,		CALIBRATION DATE	FION DAT			PROBE NO.	, V	
•	CONTRO	L BOX 0	CONTROL BOX OPERATOR X	7	STATIC PRESSURE	RESSURE	-1.00	40	PITOT CORRECTION	RRECTIO	N 0.87	,	FILTER NO		
•	BAROME	TRIC PR	Ō.	ე ე	PORT DIRECTION	ECTION	1200 T	4	CONTROL BOX NO LUBOH	BOX NO	WIECH -	* 52.00	STACK DIA	A. (32	
	Travarse	Time	Dry Oac	Pitot A P		Orifice a H	Meter Te	H	Vaccount	Sect	Probe	lapinger	Hot Box	Contractor	
	Point		Motor Reading	(0,41	Req'd.	Ad.	4 (3°)	3 E	F. He	je	Į E	, <u>, ,</u>	<u> </u>		
	_	817: HI	Ò	(2)	209	209	100	60/	2.5	1	~20°r	16 84 Fres	14	3/200	1
	_	77.77		4)	2.09	800	13	107	W.S	-				Peders Groven	Sea
				4,	209	2.09	3/1	100	マシ	389				50.00	
				/2	209	2.09	1	201	35	299					
	1			1.2	209	207	148	(0)	3.5	986					
				/ /	261	261	1 61	60/	35	298					
	193			0 /	52 /	1.75	001	50/	35	298					-
				1.0	1 20	1.75	(20	103	3.5/	7%					
				0.	126	1.75	121	103	3.5	32%					
				0.7	1.75	1.75	121	/03	3.5	399				-	
				/ /	261	1.83	122	103	3.5	293					
				60%	1567	527	801	< 9/	35	298					
	3			260	1.57	1:57	123	103	3.5	897					
				80	0/1	1.40	133	103	5:0	299		-		•	
				05.	011	041	122	103	5.0	289				Estimates:	ľ
•				285	8/1	841	120	60/	3.0	× 99				MW- 29	3
				.85	148	841	1/9	103	3.0	298				XH20- 7	
		61.91	970.300	28.	148	146	119	103	30	2%6					7
-	SYSTEM	SYSTEM LEAK CHECK	ECK		PITOT LEAK	K CHECK			Impieges	Impiages	12.	i	•	ļ	
		Vecuum	DOM Rate			Positive	Negative		χο.	Contents	cents		Lestina	Dulerance	
		(fa. Hg)	(cfm)		Before										
	Defore]			Affer				7		•				
	Aber					-	~		-						
	26	12 1 90 MG	10 mei	•	S				•						
27	97	1 DALE	67.02/d	t	8			_		,	11/4			7	
		(4)	8		ž				velocit	111	velocity = 107.10 71/200	7	X	KEYSTONE	NE
3	AQE 2/12	(年)	AGE 200 (4)/AE - 1.		Gate.	12.	ر چ چ	1	R		1-6,2% (1-1)	(1=)	ビ		l É
-	1	1111/	1.1.		ţ	-	JG 1901								

					STAC	K SAMI	PLING	STACK SAMPLING DATA SHEET	HEET				Page of 3
CLIENT	CLIENT BAH/6	70%	!	TEST DATE		7-27-93		ORIFICE (ORIFICE CORRECTION	ON (.82)	7(HOT BOX NO.	Š.
TEST U	NIT SB	0 11 0		TEST NO. A			£7.£	METER C	METER CORRECTION	0.9649	19	COLD BOX NO	NO.
PROJEC	BOX C	PROJECT NO. 75-602 8	7,		PRESSURE			PITOT CO	PITOT CORRECTION	41	5	FILTER NO	
BAROM	ETRIC PR	a.M	, q.q.	PORT DIR	IRECTION	1		CONTROL	CONTROL BOX NO. P. 2	1 1	Par-116-5	STACK DIA	
Traverse	Tire	Dry Gee	Pitot A P		Orifice A H	Mater To	mperature	Vacuum	Sect		Impinger	Hot Box	Comments
Pois M		Moter Reading	(je, H20)	Reg'd. (is. K20)	Act.	<u>د</u> ق	\$ E	3	ا ق	Teamp.	Temp.	1 5 5 (1)	
1	855	467.346		20	2.0	65	£6	6.5	1	-	651	1	
	700	472.6	-	20	2.0	1819	8%	9.0			63		
	1///	480.9		20		119	4/02	9.0			10)		
	525	450.9		20	220	124	£(2)	9,0			57		
	5%	468,2		2.0	2-6	127	011	9.0			45		
	727	SOL 6		2.C	20	128	113	9.0			53		
	1,55	5/5.2		2-0	2.0	130	Ьij	9,0			24		
	105	573.8		0,1	2.0	131	115	1.0			25		
	=	523.9		2.0	20	132	<u>ي</u>	9,0			52		
	12/	8,042		20	2.0	132	1)7	910			27		·
	1135	5 PY 2	_	2.0	20	132	ナニ	1,0			55		
	17-11	558.0		2.0	2.0	132	113	9.0			24		
	115	256.7		2,0	2.0	132	11.2	9,0			7,5		
	1205	575.0		2.1	2.0	(31	118	9.6			53		•
	12/2	583.6	!	2.6	210	134	120	0.0			53	_	Estimates:
	1235	2,265		218	2.16	13	(II	40					MW=
	1235	100° o		20	20	133	120	0,1			53		%H20-
	1245	4000.7	_	2.0	20	134	119	9.0		-	53	-	
SYSTEM	LEAK CHECK	BCK		PITOT LEA	AK CHECK			Imputer	Impielo	\$.	,		!
	Vacuum	DOM Rate			Positive	Negative		2	Contract	3		Initial	Difference
	Gr. Hg	(c(m)		Pefore				-					
Befoir	0/	0.012		After	-	,		7, -					
2	1	2:2:2		203			-	-					
				03			<u> </u>	*					
			_	8 9								لم	7
AQE 2/92				22								X.	KEYSTONE

CLIEN	1 /2#6/1	CLIENT PAHOLO DOS		TEST DAT	DATE 7-27-93	262		ORIFICE (ORIFICE CORRECTION	1281 NO	ਨ	HOT BOX NO.	NO.
TEST (INT AR			TEST NO.	J	N-58-MIN -337	777	METER C	METER CORRECTION	10	9/10	COLD BOX NO.	X NO.
PROJEC	CT NO. 93	PROJECT NO. 93-CC28		NOZZLE (101			CALIBRA	CALIBRATION DATE	4	1-05	PROBE NO.	(0
CONTR	CONTROL BOX OPERATO		Brank	STATIC P	C PRESSURE			PITOT CO	PITOT CORRECTION		¢	FILTER NO.	0:
E CONTRACTOR DE LA CONT		∜,	Pieze A P		Original Line	Meter Term	A CONTRACTOR OF THE PERSON	Vermus	1	7	1977 191	TOLT IN LAW AND A	<u>-</u>
, S		Moter Reading	Ę.	Req'd.	Ad	ع <u>و</u>		(ir He)	1	ا بو و	Temp	Teap.	
	7761	612 (9		2-0	2.0	134	55	9 6			24		-
+	12.5	٠.		7.0	7.0	124	50	0	 		カン	-	
-	17/2	٦			0,70	12.5	1	اد در اد	 -		22		
-	123	8./501	-	200	2.0	12.5	22	10.0		-	5.3	-	}
-	1335	-		0,7	0.4	35	421	. S.	-		45		
-	1345	9.859		at	00	725	121	0	_		53	_	
-	1355	(1620)		かて	7.0	13.5	121	12.0			23		
-	1405	675.6		20	20	133	171	12.5			53		
-	14/5	1084.4		2.0	2.2	h£1	171	12.0			23	_	
-	SPH	(4713.1		2.0	7.0	134	171	120			55		-
	1435	101.8		0.7	20	134	121	12.0			hS		
	\24HZ	Z.017		2.0	2.0	135	72	11.6			52		
	1455	18.81E		7.0	2.0	135	122	11.0			52		
-	15.75	2. F.F.		2-0	2.0	134	771	0.11			15		
-	15/15	h.set		2-0	2.0	136	221	_	-		15		Estimates:
	18235	8 hht		2.0	20	134	(22	(1.0					MW-
	1536	34215		2.0	2.0	F\$1	271	0~17			75		%H20-
	745/	0.197	-	20	20	135	123	וויסון)	5		
YSTÉM		ECK		PITOT LEAK	K CHECK			Impinger	rs]eigni	t t			
	Vacuem	DOM Rate	+		Positive	Negative	•	Š	Contents	2	Fine	laitia L	Difference
	(in. Hg)	(cfm)		Before			<u></u>						
Pefor				After				~					
Ash			_		-	2		pi),					
				7 6				<i>•</i>					
				8			_						
			- 1	2			٠					<u>ئ</u>	VEVETONE
A O E 3 B3			4										֓֡֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜

							- -				•		91
TICAL	K. 1/1/1	200		TEST DA				ORIFICE CORRECTION	ORRECT		イ	HOT BOX NO.	<u>(</u>)
TEST U	TEST UNIT SA	377 8			7		727	METER CORRECTION	ORRECTI	ď	20	COLD BOX NO	((
PROJEC	T NO. 93	PROJECT NO. 93 - CC 2 8	t	NOZZLE				PITOT CORRECTION	RECTIO	N + (C)		FILTER NO.	
CONTR	CONTROL BOX OPERATO	ESSURE 22	1227 1220	PORT DI	RECTION			CONTROL BOX NO.	BOX NO	11	Portlans	Partia STACK DIA.	
	1		J. Polici	Ŏ	Orifice A H	Motor To	mporature	Vacuum	Stack	Probe	Inspinger	Hot Bos	Comment
F. F.		Meter Reading	4	, 1 (1)	Act.	ų, (3°)	₹£	(i. Hg)	įE	Temp.	(*C/*F)	E	
	44.4	(Sec.)	1 100	╅	0.0	727	771	5	-	1	52	1	
H	600	757.1	\uparrow	 	7.0	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	122	1.5		_	53	_	
4	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	フランター	\downarrow	7 0	(2	727	レー		_	43		
4	1/0/2	105.761	+		2	3			_	_	_		
+	_		+	-						_			
4	-		+										
4	_		+									_	
_			-	-\ \						_			
									+	-		-	
-									_			-	-
-									+	+		+	
-			_							+		+	
-										+		+	
									-				
			-	<u> </u>								-	Estimates:
+			+										MW-
+			1										\$H20=
+				-									
everel.	EVETEN I FAK CHECK	ECK		PITOT LE	EAK CHECK			Impinger	der I	Ітрівдет	i		O. C. C.
	Vacuum	DOM Rate	_		Positive	Negative		Š	3	Contemts			
	Gr. H.C.	(c[u)		Before				,			1		
Before	╁╴			Affer			_	, , , , , , , , , , , , , , , , , , ,		•			
A.P.					-	7	_	4					
				8	+			<i>i</i>					
				8								4	4
				Z								\ \	KEYSTONE
							1					*	

PLANT niles, Ohio, Ohio Ediso	4,
DATE 7/29/93	
SAMPLING LOCATION ESP wlet	
N-4-MUM-729	

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ O	ΔHę	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), °F	T _{mavz} .	105
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B _{wo}	7
BAROMETRIC PRESSURE AT METER, in. Hg	Pin	28.77
STATIC PRESSURE IN STACK, in. Hg		
(Pm±0.073 x STACK GAUGE PRESSURE in in. H ₂ O)	Ps	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P ₂ /P _M	1.0
AVERAGE STACK TEMPERATURE, °F	T _{\$avg.}	310
AVERAGE VELOCITY HEAD, in. H ₂ O	ΔÞ _{avg} .	0.85
MAXIMUM VELOCITY HEAD, in. H ₂ O	Δp _{max.}	1.10
C FACTOR	0	7.95
CALCULATED NOZZLE DIAMETER, in.	0	.235
ACTUAL NOZZLE DIAMETER, in.	0.	182
REFERENCE Δp. in. H ₂ O	2.	20

EPA (Dur) 234 4/72

Checked by:

	1	LLECTED_ms	PROBE WASH
397	I RATE	OF PARTICULATE COLLEC	FILTER
METER AH	PROCESS WEIGHT RATE	WEICHT OF PAR	SAMPLE
22.76	,	Ġ	0,182

					4	STAC	STACK SAMPLING DATA SHEET	LING	YATA SI	HEET	1.	1.720	— r	Page / 01 4
Ú	CLIENT	10 11G	Katterial DOE		TEST DAT	TE 07-5	07-29-93 (TMS.		ORIFICE CORRECTION	ORRECT	NON ALESSE	80 CX	HOT BOX NO.	0.
, t <u>e</u> ,	TEST UNIT	IT STACK	ck - HOT	ک بلا	TEST NO.	4-59	١,	7.38	METER CORRECTION CALIBBATION DATE	TON DAT	-	# 0.993	PROBE NO 6.	20 / C
ler ic	ROJECT	NO.	PROJECT NO. 93C028-6	150	STATIC P	PRESSURE - (-10 KD		PITOT CORRECTION	RECTIO	78.0 N	4	FILTER NO	ĴŹ
عد) <u>ح</u>	AROME	TRICPR	BAROMETRIC PRESSURE 2.8. 8/8		PORT DIRECTION	ECTION	3 ₹ J	8	CONTROL BOX NO. JUNECA	BOX NO	. NUTECH	X150/-7	STACK DIA	132 "
-1 <u>C</u>		Ties	Dry Que	Pace A.P	ē	Oriston A H	Meter To		Vectoral	I	Probe	Impiager	Hof Box	Comments
	. T		Mater Reading	f. 120	Stant'd.	Act.	3 E	# (£	(is. Hg)	įE	įE	Temp. (*C/*F)	1	
		0,70) 0		7.01	2.0/	2	de C	3.0	160	~250%	3,897	~280×	30 min 10T
	7:10	07.00		, , ,	20/	201	78	85	3.06	291				2401-55
				1:1	20	201	8.3	96	3.0	37.				exer 6m2.
				,	100	2.01	86	87	3.0	280				
				, ,		2.07	86	87	3.0	291				
				/ /	2.01		201	62	9.0	762				
	9.2			95	174	174	108	87	75	1600				
				95	1.74	1,74	801	67	25	29/				
				8	174	1.74	90/	25	2.5	291				
1				10	1 74	1.74	50/	8	2.5	290				
<u></u>				6	1,74	1.74	7.05	83	2.5	230				
				96	1.74	177	307	90	2.5	390			•	
	à			a S	5	1551	106	60	2.0	290				
	2			8 7	155	183	90/	96	20	230				
<u></u>				1/2/	1,37	1.37	167	2	2.0	160				Ë
				15	1.37	-	ر9/	06	20	180				36
ـــــــــــــــــــــــــــــــــــ				75	137	137	101	90	2.0	291				*H20- 7:0
		250	112.30,1038.711	17,	137	1.37	109	90	30	48/				
7 ~*	SYSTEM	SYSTEM LEAK CHECK	LECK.		PITOT LE	EAK CHECK				Ī,	and		الغفرس	1.1.7% Self. 1.
<u> </u>		Vecess	DOM Rate				Z. Tall		ġ.	7		1610	11500	the proper
		(F. Hg.			Pefore	27/08/20	• 2/5 Ec.		1.	15001	140/4D	756,3	631.2	7 ;
	5	200	2000	ک			7		3.	1795	(a)/ko	642.2	417.6	य पर
سر م	*		2	:	200	5.17	145		4	[2]		486.5	48/0	200
N TO	14601	,	1/2 036 dec	,	20	6.5	6 Č		S	zil.	30453	677.5	636.5	2/12
3	QV)	-	55.0 57.0		2 3	29.0	27.0		., ė	1 29 2 25 2 3 5	_	, oo	سي	KEYSTONE
	AQE 2017	1 1 mg	71		1.40.10	elete 2	10 / 0 / 0 / 0 / 0 / 0 / 0 / 0 / 0 / 0 /		CA THE TEN	ICA K.		67 001	لأ	7
	-	שני אול	C11) - 6WW	(T)	-45 F	· (T	Lize Mir		Inches w	שאונט, כיו				

						STAC	STACK SAMPLING DATA SHEET	FING	DATA S	HEET	1.720	õ		Page 2 of 4/
	CLIENT	BATTBLUG	300/ 57	,		TE 0728	-93	(WW)	ORIFICE	ORIFICE CORRECTION		200	HOT BOX NO.	NO. /
r (TEST UNIT	NIT STACK	I i I	5,46	TEST NO.	N-59-	- שחע	729	METER C	METER CORRECTION		940.93	O. 994 O. 939 COLD BOX NO	
-	PROJECT NO.	1 NO.	PROJECT NO. 93COAS - O	700	NOZZLE ((SIZE, I) D. 22 Z	77 17		CALIBRA	CALIBRATION DATE	100		PROBE NO.	54.76
- 1 	BAROM	ETRIC PR	BAROMETRIC PRESSURE 2.3			RECTION	4	را	CONTROL	CONTROL BOX NO. WITCH	•	C70288	#CTO275 STACK DIA	132
_	Traverse	Time	Dry Ge	Pitot A P	ō	Orifice A H	Moter Tem	mperature	Vecuum	Stack	11	Impieger	Hot Box	Comments
	je j		Meter Reading	(j. 1720)	Req'd.	Act.	• £	9 £	ê. He	<u> </u>		Temp.	Temp.	
<u> </u>	24 /	0.35	11207	,	2.79	2,7	8	E.	N	14,	1	(68 B	250 %	20/ 100
				16	2.//	2.00	16	8.8	2.8	282	-			640 mg 6 mg 44
				a	2.19	2.69	70/	36	35	160				
•				72	2.18	5.18	105	B	35	268				
•				7)	2.19	2.8	901	- 31	3.5	282				
				7.2	219	110	401	71	3.5	765		`		
	19.3			7.2	2.19	2.19	80/	82	3.5	231				
				(3	2.19	61.0	801	92	3.5	760				
<u> </u>				4	2.78	6'6	692	26	3.5	160				
-				7.7	6' 0	2.5	301	28	3.5	160				
<u> </u>				/ /	2.01	100	601	16	3.0	065	-			
				/-/	12.01	10.8	0//	91	3.0	29.3				
	2.0			01	1.83	1.83	601	3/	w 0	294				
				0.1	1.83	1.83	601	- 16	3.0	291				·
				-36-	1.74	174	107	93	3.0	295				Estimates:
1				0%	183	1.83	60/	تم	- 1	394				MW- 29./
	-			07	13	183	13	92	3 C	288				SH20- 7-0
		120	116 971	8.	1.69	160	101	23	0 M	295				
1 47	SYSTEM	I LEAK CHECK	EČK		123	AK CHECK			Impinger	Impiager				
		Увсии	DOM Rate			Positive	Negative		2	Contents		Fine	Tairie I	Difference
		(je. Hg)	(clm)		Before				<u>-</u> :					
	Before				After				2.	•				
لب	Alber					_	7		~					
بق	F	TOME - 90 min	Do some	4	600	i Si			-					
4		Kont	voume = 72.560 dcl	ू इ	8	0				1		7 9 4	7	7
Rang		1 10 1	0111 = 110 / meson	•	ZY	4.0	7				,-	+0:1 pac	•	KEYSTONE
	2	1-12	7700	1	17-	186	15/1		23000	 19	= 99.	94.1%		7

Page 7 Sept		6-9939 COLD BOX NO. /	PROBE NO. 64 Traz / 5		\parallel	Total Box	te.	1	0000	1	2000											Estimates:	WW= 2 9.	KH20- 9. C			Initial Difference					7-1-5	KEYSTONE	
,		4		77	7/07/2		(4.D.)	163° 500 2	1																		Fire					2/0 She	1:0 18	= (00, 3%
ATA SHEET	ORIFICE CORRECTION ,	METER CORRECTION -	,	CONTROL BOX NO 2.	Vacuum Start Profes		(in. Hg) (*F) (*F)	25 5 294 12800	3.5	3.5 295	35 235	3.5 296	3.0 292	30 893	35 294	35 295	3.5 238	3.5 295	3.5 295	3.0 295	3.0 294	3.0 295	0	30 294	30 34	<u>.</u>	No. Contents		,		5.	Jeloushy =		JSO.
STACK SAMPLING DATA SHEET	29-93 (MUR) 0	-MUM -729 M	$\left\{ \right.$	10 mg	r Temperature	3	(F)	13 90		06 701	06 70/	107 92	108 92	108 92	108 93	100 92	109 13	1.09 73	09 13	_	83	176	108 94 3	109 94	109 94		Negative					7	7`	(Tan. 1) an - 2940F
STACK	ATE 67-	TEST NO. N. 54	CTATIC DECELIE	PORT DIRECTION	┧┝		(in. H20) (in. H20)	214 214	2.19 2.14	214 3141	214 R.14	2	196 1.86	2.14 2.14	214	7.14 2.14	71.6	2 2 32	87,53	1.69 1.69	160	60%	169	168 1.69	1.69	CHECK	TOBING I	After		cos WS	9	- 1	m 1470 1	ander Jais - 99%
	-	5,06	000	388	Pitot A.P.		(le. H2O)	7/1/2	12	1.2	1,2	7.7	7	6.7	(2	77	77	7		67	122	78/	X	95	18	ſ	L	<u>-</u> -	<u>.</u> T		i de		٠ لـ	ש
	BATTGUE	PROJECT NO 020 4 - 0	CONTROL BOX OPERATOR	BAROMETRIC PRESSURE 28	a i	<u>*</u>	1	1/2/6/11/07						3			-			8					1346/184 672	Verme Forest				TIME TO MAY	ق		AGE 2002 (SP) AGE TO LOUIS	1 AH Jac = 2.00
-	CLIENT	PRO		BAR	Traverse	. T.		<u>₹</u>					1	787						2.8					30.0			Before	Alber	Brot. Th	+3-	a a		

						STACE	STACK SAMPLING DATA SHEET	LING L	NATA SI	HEET		Ç.	- 1	Page 4/ of 4/	
					TEST DAT	TE 1 7	-29-93	(SUM) 6-9	ORIFICE CORRECTION	ORRECT	· {	120 KK	HOT BOX NO.	10. /	
**	CLIEN! A	• ∩ I.	100	7,7,7			21/20	1 -	9 METER CORRECTION	RRECTIV	ON AP	9940995	_	NO. /	
•	DEST UNITY	1 V V V V V		0	NOZZI E (ISIZE N O	0		CALIBRATION DATE	TON DAT	ļ		PROBE NO.	CATTELLE S	λ.
•	CONTRO	N BOX O	CONTROL BOX OPERATOR	PC	-12	H	1//-	140	PITOT CORRECTION	RECTIO	N O.oy	1 1	FILTER NO.		١.
•	RAROMI	ETRIC PR	RAROMETRIC PRESSURE 28, 80	88	PORT DIRECTION	ECTION	PORT-	A	CONTROL BOX NO NUTSEH	BOX NO	NUTSCH	. t 1	-/02pS STACK DIA		
		1	Des Class	Pitot A P	Po-	Orifice A H	Moter Ten	aperature	Увсачи	Stack	Probe	Inpinger	Hot Box	Comments	
	Point		Moter Reading	Cr. HOON	Req'd.	Act.	٠. و	\$ E	(s. Hg)	į.		Temp. (*C/*F)	Temp. (*F)		
	(mcbae)	135.9	(100)	7	7/6	2./4	9,6	16	35	273	-350	10° 500	2000	30 0x 10T	
	27.1	/ 33		5%	2/2	2/4	103	16	3	275				Readings	
					1,8%	186	10/	92	w V	295				Gudes Som	
				, ,	76'	2%	206	95	8.5	273					
				, ,	767	767	101	25	3.5	349					,
					1.96	1.96	801	83	3 8	298					
	8			17	%	2%/	20/	93	3.5	29%					
				3.0	1.78	841	101	93	3.5	3%6					
				0 /	341	84.	201	93	3.5	299					
				01	1.28	841	60/	46	35	295				•	-
			·	7.0	1.10	841	109	46	38	394					
				0%	84%	7.70	801	28	50	367					
	CR			75	1.34	1.34	109	94	3.0	295					
				17.	45.7	1.34	601	36	3,0	2%5					
				1	7.5	1.34	101	46	3.0	295					
				7	1.34	134	1001	35	30	395				2	 _
				74	1.34	1. 34	0//	95	30	300				*H20- 7.0	
		15.29	252.070	R	/34	1.34	7/17	96	3.0	388					_
-	SYSTEM	4-	ECK		PITOT LEA	K CHECK			Impinger		Impieger	i		Difference	
			DOM Res			Positive	Negative	•	Š	3	Contents		Inches	The section	
		G. E.			Before			•							
	Pe Con		<u> </u>		After				2.						
	N.					-	7		-						
		16-14	7	-	C03	14.6	14.5		÷						
24		ر ا ا	. OCT 2.	7	20	79	6.0		×.		1	·	T		
7.7	>	orume =	VOLUME = 67,570 09	2	8	9	P			Ž	シーな	which = 66.0 Hac	~ `	7,	
मुख	20.00	(AD)	10/ch 12 12 10/06 = 0.95	•	Z ,	710	40			[8 ا ا	809%		KEYSIONE	
,	* S 25 Y	۱. ز	;	7	-	70.5	Ŧ.	7	1,0,0,	j K	Ì	 5	J	1	

The Old Color Colo	CLIENI FEST U	TEST UNIT SE	300 0		TEST DA	N-5B	10	729	ORIFICE METER C	N-58-MIN-729 METER CORRECTION	دار	1287	HOT BOX NO.	% %0.
Time Marke Reasone Average Professione Average Average Professione Average Professione Average Ave	PROJEC	T NO. 9		Burth	NOZZLE STATIC P	(SIZE,A) RESSURE			CALIBRA PITOT CO	TION DA	4	63	PROBE N	0
100 100	BAKOM	E INIC P	3	88	PORT DIR	ECTION	}		CONTROL	L BOX NC	11	Portia.	STACK D	٨ /
Color Colo	Point		Meter Reading	TEG A F	9 1	H V SOL	Meter T.	S S S S S S S S S S S S S S S S S S S	A Charles	ja je		Impieger	Het Box	Common
100 176 9/8 2.2 2.2 48 18 11.0 164 164 165 164 165 164 165 164 165 164 165 164 165 164 165 164 165	(je b		(dec)	(ia. H2O)	(in. H20)	(in. H20)	(£)	E	Gr. Hg	E	Ė	5	<u>.</u>	
17.2 14.4 2.2 2.2 106 96 11.0 604 18.2 18.2 2.3 18.5 18.5 18.5 18.5 18.5 18.3 18.2 2.2 2.2 18.5 18.5 18.5 18.5 18.4 2.2 2.2 12.4 18.5 18.5 18.5 18.5 2.2 2.2 12.4 18.5 18.5 18.5 18.5 2.2 2.2 12.5 18.5 18.5 18.5 2.2 2.2 12.5 18.5 18.5 18.5 2.2 2.2 12.5 18.5 18.5 18.5 2.2 2.2 2.5 18.5 18.5 2.5 2.5 2.5 18.5 18.5 2.5 2.5 2.5 18.5 18.5 2.5 2.5 2.5 18.5 18.5 2.5 2.5 2.5 18.5 18.5 2.5 2.5 2.5 18.5 18.5 2.5 2.5 2.5 18.5 18.5 2.5 2.5 2.5 18.5 2.5 2.5 18.5 2.5 2.5 2.5 18.5 2.5 2.5 2.5 18.5 2.5 2.5 2.5 18.5 2.5 2.5 2.5 18.5 2.5 2.5 2.5 18.5 2.5 2.5 2.5 18.5 2.5 2.5 2.5 18.5 2.5 2.5 18.5 2.5 2.5 2.5 18.5	1	0,600	196 9CK		2.2	2.2	8%	8	11.0		-	1/2		
14. 4 2.1 2.3 11.5 69 11.0 60 15. 2 2.2 2.2 17.5 10.5 11.0 60 15. 0 14. 4 2.1 2.2 2.2 1.2 11.0 11.0 15. 0 14. 6 2.2 2.2 1.2 11.0 11.0 15. 0 15. 7 2.2 2.2 1.2 11.0 10.0 15. 0 15. 7 2.2 2.2 1.2 11.3 10.0 15. 0 2. 1 2. 2 2. 2 1.2 11.3 10.0 15. 0 2. 1 2. 2 2. 2 1.2 11.3 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 2 2. 3 1. 4 10.0 15. 0 2. 1 2. 3 1.		0%0	105,6		2.2	7.7	901	2	0.1/		_	40		
13 13 2 2 2 2 13 10 10 10 10 10 10 10		0550	h . h/l		スプ	2.7	115	8	<u>0</u>	_		19		
12 12 12 12 12 12 12 12		69 30	123.2	_	7-7	2.2	1.7	101	1.0			180		
0950 440.7 2.2 2.2 126 11.0 558 1600 1500		Ofto	_'		て、で	7-7	150	79/	0, =		-	88		
100 58.7 3.2 2.2 126 110 120 57 100 58.7 10.2 10		0260	140.7		7-7	7-7	77/	70%	17.0			%		
		000	147.6		7.7	2.7	126	23	11.0		_	5		
10 20 16 7 2.2 2.2 128 112 10.0 54 10.0 10.0 55 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0		0101	788.7		7.6	,	127	(1)	10.0			5		
(1.20 176.1 2.2 2.2 12.8 13 10.0 55 10.4 184.6 2.2 2.2 2.2 12.8 13 10.0 55 10.0 55 10.0 50.2 10.0 10.0 50.2 10.0 10.0 50.2 10.0 10.0 10.0 10.0 50.2 10.0		0201	1621		7.7	1	28	71	S 0.		-	25		
1040 184.6 2-2 2-2 128 13 10.0 65 10.5		10.30	176.1		7.7	1 .	12.8	E3			-	25		
1050 93.4 2.2 2.2 128 113 10.0 4795 110 210.4 2.2 2.2 128 113 10.0 5.2 2.2 2.2 128 113 10.0 5.2 2.2 2.2 2.4 14 10.0 5.2 2.2 2.4 14 10.0 5.1 1.0 1.0 5.1 1.0 1.0 5.1 1.0 1.0 5.1 1.0 1.0 5.1 1.0 1.0 5.1 1.0 1.		0401	9.781		7-7		128	113				59		
1100 260,		0501	193.4			77	128	[[]	10,0			5		
11/2 210.4 2.2 2.2 12.8 113 10.0 5.2 1.2 11.2 10.0 5.2 1.2 11.2 10.0 5.2 1.2 11.3 10.0 5.2 1.2 11.4 10.0 5.2 1.2 11.4 10.0 5.2 1.2 11.4 10.0 5.1 5.1 1.2 1.2 1.4 10.0 5.1 1.2 1.4 10.0 5.1 1.4 10.0 5.1 1.4 10.0 5.1 1.4 10.0 5.1 1.4 10.0 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5		1109	202.1			7.7	LT1	113	(0.0			A SA		
1/20 2 [9, 2 2-2 2-2 128 113 10 to 52 130 338, 2 2-2	-	1110	_ ~ /		انہ	2.2	128	113	10.01			ر الم	_	
1/30			219,2		7-7	2-2	128	113	0,01			22		Estimates:
1/40 236, 2-2 2-2 1/4 10.0			228.2		2.5	2-2	129	114	0.01			22		×.
1/50 245.8 2.2 129 14 10.0 51		1140	236.1		2.2	2-2	120	14	0.0			٠,٧		₹H20-
LEAK CHECK		150	245.3	-	2.2	77	129	 	0.01			1		
Vacuum DOM Rate Fond faiting (ia. Hg) (cfm) After 1. 2. 2. /5 (f, O0) After 1. 2. 4. CO2 CO2 5. 5. 5. N2 N2 7. 7. 7.	STEW	EAK CHE	CK	<u> </u>		- 1.	[Impiager	Impin	Į.			
(iii. Hg) (cm) Moder 1		A COMP	DOM Rate				Negative		2	Confe	*	Find	faithe	Difference
3 1 2 3 5 5 5 5 5 5 5 5 5	110	E HE	(clm)	1	Defore	1								
CO2 CO2 CO3	A A SE	4		_	Aner	-	7		7				T	
S		, -	10000	L_	200	-	•	· ·						
2N 2N 2N				<u>.</u>	70			•	- S					
N2 To The Table 1 To				LL	8								14	4
	DE 2002				22			•					^	

) } !		i				
LIEN	CLIENT Sottolle	6 705		TEST DATE	7	H		ORIFICE C	ORRECT	ORIFICE CORRECTION (AHD) /. \$2		HOT/COLD BOX NO	BOX NO.
	UNII OK			IEST NO.	7, 5	5-MUM-2	-729	METER CORRECTION (Y	KRECT	_	9649	PROBE NO.	(
ECT (TEST CEEW TO	276		NOZZLE (E (SIZE, I)			BITOT COBBECTION	TON DA	7-16	-91	FILTER NO.	()
ARO	BAROMETRIC PRESSURE	ESSURE 28	83	PORT DIR	DIRECTION			CONTROL BOX NO.	BOX NO	Roxz	Portlan	PORT SIZE	۱۱
Traverse	e Time	Dry Gas		Orifice	H 4 80	Meter Te	Temperature	Vacuum	Stack	 4 5	Impiager	Hot Box	Comment
Poist Echae (sechae)		Mater Rending (def)	(ie. H2O)	Required (in. H20)	Acted (is. H20)	a (f.)	9 3 3 3	G. H.D.	<u> </u>	1	Temp.	Temp.	
}-	رورزا	E'HSC	1	ンプ	7:6	129	27	10.01	I	カン	 		min./boing
-	1210	2(12.9		22	7:7	129	7//	10.0		5			
_	מכבו	272.1		2.2	7.6	129	<u>=</u>	00		777			
	1230	9.08 €		7.7	7-7	129	ЬII	100		8th			
_	1240	~		2.2	2.2	129	וות	10.0	_	45			
	1750	19.268		2.2	2.7	671	<i>h11</i>	10.0		1,3			
_	1300	206.0		7.7	7-2	(کے	h11	10.0		52			
_	1310			7-7	7.7	121	61	20.0		52			
	1520	374.1		2.2	7-7	129	F47	ا ان		3			
L	1330			7.5	22	121	h1	501		1.5			 _
	1340	341,		22	22	725	١١٦	ල-01	_	ζ,5			
	1356	349.6		22	2-2	130	115	0.()]		15			
_	1400	358.2		2,2	2.2	130	166	0.0		5,5			
	1410	567.7		77	7-7	30	115) V, C		52			
	14.20	376.2		2-2	2.2	18	(3)	10.0		\$2			
	1430 L	385.0		22	2.2	130	//5	10:0		54			Estimates:
	9hh	1 t'hat		2-2	۲, ک	130	1/5	10.0		24			-MW
	95hl	950%	•	7-5	2-5	120	1//	(0.0					\$H20=
STE	SYSTEM LEAK CHECK	EQ.	• • •	PITOT LEAK	K CHECK			Impinger	Impiager	Į.			
	Vacces	DOM Rate			Positive	Negative	•	No.	Contents	ınte	Final	laitial	Difference
	(is. Hg)	(cfm)		Before	1								
Belore				Alber				7					
No.			_	88	-	~		eri .					
				3 8			··•	÷ •		+			
				8			•						
			2										

Poge 5 of 3	BOX NO.			Comments		min./point												Estimates.	MW-	\$H20=	İ	Difference					AQE 6/92
<u></u> ,	ORIFICE CORRECTION (4 HØ) 1.821 HOT/COLD BOX NO METER CORRECTION (Y) 0.9649 PROBE NO.	FILTER NO. STACK DIA.	JPORT SIZE	Hot Box	(F)	-				1 /					1		1	-				Initial	+	}			₹
	1-8-1 (-93	न्य प्र	Impinger	(°F)	kS																Fine					
STACK SAMPLING DATA SHEET	TION (A HO	TE 7-11:	7 27	l.	(F)			_			_/_									,	# <u> </u>	Contents					
HEET	CORRECT	CALIBRATION DATE	CONTROL BOX NO.	 	(7)			[]												-	Impieda	3		-			
DATA SI	- 1	1 1	CONTR	Vactours	(is. Hg)	9							_						-		Impieger	Š	<u>-</u> .	ri -	4	S	
MPLING	3-729	1 1		Temperature	3.5	-415								_		-		+				•	- _T	٦		- T	Т
TACK SA	7-29-93 -512-1112	<u>ן</u>	7	H	. E	130					 							-			×	Negative	-	- -			
S	OATE 7.	NOZZLE (SIZE,) - STATIC PRESSURE	DIRECTION	3	(e. H20)	12.			 <u> </u>	 		-					$\frac{1}{1}$	+		_	LEAK CHBCK	Positive	-	\ -	. 		+
}	TEST DATE	NOZZI	PORT		O) (le. H20							-		~					-		PITOT L		20	Alex Services	8 8	8 8	3 5
			28.68	Page 4	(is. H2O)	1)					_						-	+	-	 	ſ .	_	_	7		
	200 %	31,028	BAROMETRIC PRESSURE 2	Dry Clea	(¢et)	ft 114	í									i .					E E	DOM Res	(E)				
	CLIENT Ratelle I	REW D	AETRIC PR	Tions		1882															SYSTEM LEAK CHECK	Vecess	(is. Hg)				
	CLIEN TEST U	PROJECT NO TEST CREW	BAROL	Traverse						-		-						+	1	1	SYSTEM			Before	Ž		

NOMOGRAPH DATA

PLANT <u>Nilso</u> <u>Chio</u> <u>Chio</u> <u>Edison</u>

DATE <u>7/31/93</u>

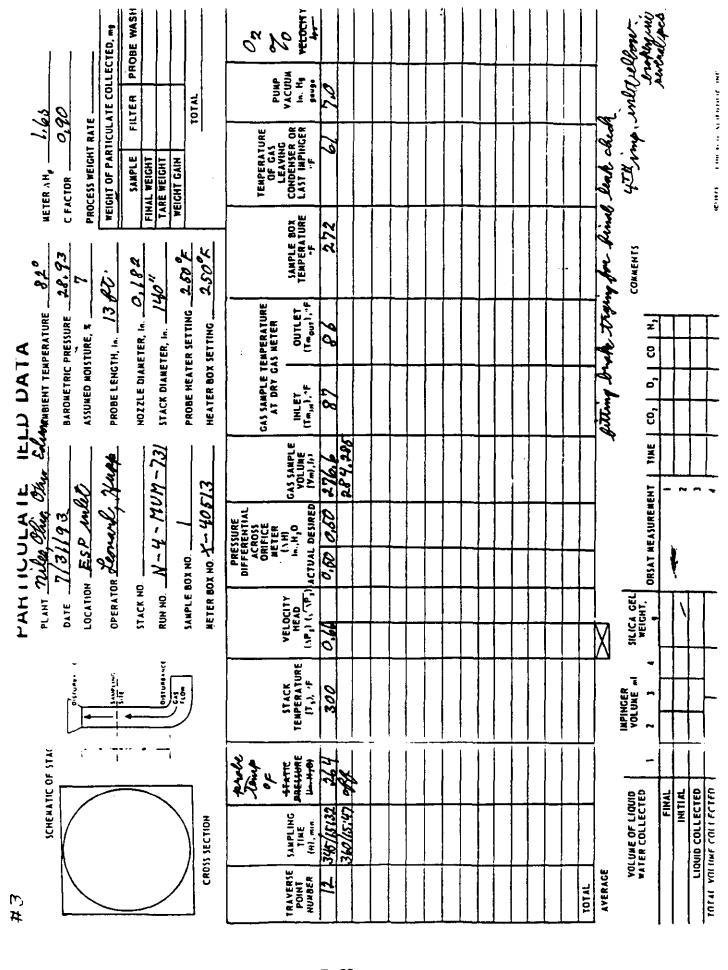
SAMPLING LOCATION <u>ESP</u> <u>inlet</u>

N-4-MUM-731

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H ₂ 0	ΔH _Q	1.65
AVERAGE METER TEMPERATURE (AMBIENT + 20°F), F	T _{mavg.}	95
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B _{WO}	7
BAROMETRIC PRESSURE AT METER, in. Hg	P _{itt}	28.92
STATIC PRESSURE IN STACK, in. Hg		
(Pm±0.073 x STACK GAUGE PRESSURE in in. H2O)	Ps	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P _S /P _{EE}	1.0
AVERAGE STACK TEMPERATURE, *F	T _{savg.}	310
AVERAGE VELOCITY HEAD, in. HZO	Δp _{avg} .	0,85
MAXIMUM VELOCITY HEAD, in. H ₂ O	Δp _{max.}	1.10
C FACTOR	1	0.90
CALCULATED NOZZLE DIAMETER, in.	0,	240
ACTUAL NOZZLE DIAMETER, in.	0,	18.2
REFERENCE Ap, in. H ₂ O	2,	20

EPA (Dur) 234 4/72

Checked by:_____



					STACI	STACK SAMPLING DATA SHEET	LING	ATA S	HEET		7,40	·	Page 22 of 4
CLJENT	CLIENT RATELLY	100€		TEST DAT	ATE 07-	02-31-33 (St.		ORIFICE C	ORIFICE CORRECTION	1	3	HOT BOX NO.	40. /
TEST U	TEST UNIT STACK	3 187.5	5,06	TEST NO.	-4	MUM	722	METER C	METER CORRECTION	0.9939		COLD BOX NO. /	NO.
PROJEC	7 NO. 9	0-860		MOZZLE (SIZE,F)	٦.	3		PITOT CO	PITOT CORRECTION	pa U		FILTER NO	FILTER NO.
BAROM	ETRIC PI	BAROMETRIC PRESSURE 2-9.00	90	PORT DIRECTION	ECTION	BET.		CONTROL	CONTROL BOX NO. PUTCCH		1028	STACK DIA	1. 122.
Travacae	Time	Dry Gas	Pitot A P	6	Orisine A H	Mater Te	Mater Temperature	Vacyren	\vdash	F	Impinger	Hot Box	Continents
T O		Moter Reading	(ja. 8720)	Req'd. (is. H20)	Ad. (m. H20)	ы (°F)	\$ £	G. Hg	Tomp.	Temp.	Temp. (*C/*F)	Temp. (*F)	
4	140	318.585	0.7	867	82 /	66	87	5.5	286 250	¥ .	2000	-250 €	500 x 107
			01	81.1	(7%	· 36	B	5.0	288				Some lossing
			10	471	821	66	68	5.0	286				
			0'	1.70	1.70	/٥٤	88	0.0	286				
			1.0	701	178	103	88	5:0	2 Y8				
			1.0	1.78	861	1777	88	20	288				
83			0./	1.78	1.78	1001	88	5:0	289			Ì	
			07	1.78	827	40/	100	5-5	510	-			
			1.0	801	\$	1,01	as	2:0	767				
			01	178	841	401	06	رزه	291				,
		-	01	1.78	128	105	90	مزه	280				
			0,	1.79	178	-6/	90	5-0	230				
30			.95	60%	1.69	301	26	7 C	281				
			96	69'	1.4.9	رهک_	90	2:0	280				
			50	168	1.69	50/	%	50	160				Estimates:
			195	1.69	1.69	501	90	5.0	160				MW-28 6
			26.	691	1.69	105	9/	2.0	0/6				8H20- 9.0
	//.5/	385.920	95	63./	1.69	165	1	8:0	21/2	_			
SYSTEM	SYSTEM LEAK CHECK	ECK	1	PITOT LEAK				Impinger	Impinger		i	•	!
	Vector	DOM Rate			Positive	Negative		χο.	Contrate	-	3		Dillerance
	(is. Hg.)	(c(m)		Before									
Before				AAcr				7	•	+			
After					-	~		ri I		$\frac{1}{1}$	•		
Rue 1	TIAE: 90	90 mm		S S	4.0			* 5		-			
	Derme =	www. 67,335 da	L	8	0		•		John South	1275	2 61/2	4	1 1
	(40)	÷ -00		N2	795				/www.	1 6	<u>.</u>		KEYSTONE
AQE 2.92	17.47	AGE UM (AU) = 1.75	F	1.4.1.	38	Total 1 - 289°F	1-289	يار.	N.	74.0%			
-	(0"/AK	21)]	5	A.C.			2						

					•	STACK	SAMP	LINGI	STACK SAMPLING DATA SHEET	HEET	-	024-	•	Page 3 of 4
_	CLIENT	BATTELLE	300/ 97		TEST DAT	Q	7-21-93 (Sat		ORIFICE C	ORIFICE CORRECTION	163	3	LAC HOT BOX NO.	0.
ie °f	TEST UNIT		1 - MOT &	5.00	TEST NO. A	1	MUM-	73/	METER CO	METER CORRECTION	0.9939		PROBE NO. R	PROBE NO. RATTERUK S
_ , _	PRUJEC	1 BOX 0	. 2	207	STATIC P	PRESSURE	7	440	PITOT CORRECTION	RECTION	1	1 11	FILTER NO.	Unionstar
,	BAROMI	BAROMETRIC PRESSURE	ESSURE 29	29.06	PORT DIR	RECTION	100		CONIKOL	CONTROL BOX NO. No. Jeef	٦I	Ы	ווע שטעונ	\parallel
	Tendere	I je	Dry Oss	Pitot A P	5	Orifice A H	Meter Ten	闡	Vacuen			apiela	Hot Box	Connects
	Point		Moter Roading	i de	Reg'd.	Ad.	4 E	\$ E	(i. Hg)	- (- (- (- (- (- (- (- (- (- (- (- (- (-	(*F)	Temp. (*C/*F)	tomp. (*F)	
, 1	(method)	10 20	12 05 - 12.0	4	2 /4	2.111	55	58	5.5	289 25	-250% <6	1025 189>	200%	30 mm/05
···			707.	4	7.7	17/0	44	Q	375	288				Sair Realiza
				7	7/4	2.14	66	90	5.8	180)
•				10	2.14	41.0	150	90	5.5	168	-			
•				6.1	10.4	2.14	105	06	5-5	760				
	į			16	2.14	2.14	100	- 90	7 /2	283				
	0			\ '.'	1961	1,96	106	90	いい	900				
	77			/ /	36'	, %	901	26	2-2	286				
•				,	1,8%	96%	90/	90	5.5	080				
				\	si	1,96	901	90	2:5	Do				~
•				1	26.1	, %	101	92	2.5	08€				
•					1.96	1,96	107	92	3:5	29/	-			
•	5			0 7	178	1.78	801	92	77	390	-			
•	9			1'1	76.1	1.910	601	94	5,5	294				
		1345	251.926	1,7	1961	1,96	109	95	910	295	-		,	Estimates:
·•		1355	451.520	/ '/	1.96	961	601	95	6,0	295	2	Freder 1	1:45	XV.
-		1405		1.15	2.05	50.2	97	93	0/9	296			1837	%HZO- %O
		TY TY	461.486	/:/	1.96	1.90	104	93	610	2957	<u>v</u>	STANTEDA	1355	
_ ^	SYSTEM	SYSTEM LEAK CHECK	ECK		PITOT LEAK				Impieger	Impiefer		-	المنفنط	Difference
		Vacuum	DOM Rate			Positive	Negative		ģ.	Contents	-			
		(ja. Hg)	(c(m)		Before				- 6	-	-			
	Before				And		\							
	Yyet					- - - - -	7		,		-			
ByR	٦	TME = 90 mG	٥ ممرم		202	077					-			
\$	ል	ING I	varue = 75. 96 det	L	8	0				= phisology		72.1 Albec	٠ ام	4
10,12		7/1 = 1/6	- 116		Z	79.5				,		102 17 1461		KEYSTONE
?	AQE 2/92		· ·	7	H L)	1, 0,00 L	F	7.02- 7/22/	740.KZ	j				7
		/VH IV	17# h_ = J.02	ې		101.)	CHI COLON						

						STAC	STACK SAMPLING	LING	DATA SHEET	HEET	`	7.70		Page 4 of 4
	CLIENT	CLIENT & TELLE	E 1006		TEST DATE	123	07-31-93	くない	ORIFICE	ORIFICE CORRECTION	Į	7	-CHOT BOX NO.	NO.
	TEST UNIT	INT STACK	ň	-5.05	TEST NO.	3	MUM	73/	METER C	METER CORRECTION	_	2.9939	COLD BOX NO.	(NO. /
	PROJECT NO.	T NO.	PROJECT NO. 93 2628-6		NOZZLE	LE (SIZE,A)	0.28	ا اعد	CALIBRA	CALIBRATION DATE			PROBE NO	PROBE NO. BATIFELL 51
	CONTR	OL BOX (PERATOR F	7	STATICP	STATIC PRESSURE	7.7	0,7	PHOT CC	PITOT CORRECTION	0,84	24	FILTER NO	. Unluke 13 H 62
	BAROM	BAROMETRIC PRESSURE	(ESSURE 2	2.90	DKI DIK	DIRECTION	1027	4	CONTROL	CONTROL BOX NO. WOTEN	WOW W		STACK DI	STACK DIA. 122"
	Traverse	Time	Dry Gas	Pitot A P	ð	Orifice A H	Meter Ten	3	Vacuum	Sect	Probe	Impinger	Hot Box	Commente
			Moter Reading (dcf)	(E. H20)	Req'd. (in. H20)	Ad. (e. H20)	• £	8 E	(ii. Hg)	Į.		Temp.	.	
	16.	14.12	461.486	4	214	4/7	6.7	93	0.0	296 4	250°	160° TE.	2002	For ler
				1 - 1	1.9%	1.96	99	8.3	0.9	 				1 /2
				/ '	1.86	961	103	63	6.0	565				
				77	1.96	1.96	105	- 93	0-9	-3680				
				1.1	961	96/	101	9-1	6.0	295				
				1.1	1.16	1.96	60/	95	0.3	760				
	19.3			0.7	821	821	101	98	09	296				
				į	427	82.1	80/	96	6.9	1060				
				5.	ď2·/	427	0 //	%	6.0	16€				
				3	82.1	86.1	011	96	0.7	300	. `			•
				0,	801	821	0//	26	0-9	287				
				0.7	811	1401	<i>⊙//</i>	26		287				
	5-8			<i>8</i>	160	1.60	111	97	6.0	394				
				06'	09/	091	111	246	09	1.60				•
				06.	097	/	112	97	6.0	399		. =		Estimates:
				06"	077	077	112	9.7	60	399		,		MW- 28.6
				01	861	861	112	77	<i>0</i>	298				SH20- 9.0
		1542	1542 530.880	06'		1.60	113	12	6.0	299				
, -•	SYSTEM	SYSTEM LEAK CHECK	ECK		PITOT LEAK	к сивск			Impinger	Impiager	h			
		Vectorin	DGM Rate			Positive	Negative	•	No.	Contents		Final	laitial	Difference
	-	F. Kg	(ctm)		Before				1.					
	Before				Alber				2.		•			
لب	After					_	1	1	1					
2	6	90	1		COZ	14.0		1	÷					
_	<u> </u>	- - -	to soul det		8	6.5			5.					
7	\$	ame "	100mg = 01.311 000		8	202				reloc	velocity = (676 He	-	7
2	105 3/83	(PP)A*	delations and (AP) AND 1.00	•	2	7.5			•	1	 - 18	(17) 60 00 =	(, , K	KEYSTONE
?		144)	CR1 = 771V	T,	Touther =	= 102°F	T.	(Tank)re >	287 F	150) % ?		
		17 11 11												

KE	YSI	ONE			STAC	K SAMPL	STACK SAMPLING DATA SHEET	SHEET					13.
P.W.F.	Niles	Olaio	DATE	DATE: 7-31-93	1-93		#V	DHP: 1.82	77		HOT BOX NO. :	NO .:	.1
LOCATION	<u>.</u> .'		TEST	TEST NO.: A	N-513- MUM-731	mun-	}	METER CORRECTION:	. NOI 13	0.9649	9 COLD BOX NO.:	X NO.:	•
ACTIVITY NO:		13-6028	MOZZLE:	Į			- 1	PITOT CORRECTION:	CT 10N:		PROBE NO.:	0	
CONTROL	BOX OP	CONTROL BOX OPERATOR D. Banco		IC PRES	STATIC PRESSURE Ps:		9	CONTROL BOX NO.:	ſ	BOX 2.8	BOX 2 Lode FILTER NO .:	₹0.:	
PROBE HAVIOLER	WOLER		PORT	PORT DIRECT	. M		2	MONOCRAPH SET POINT:	ET POINT	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	STACK DIA.:	J.A.:	
CLEAN UP			BARO	BARONETRIC	PRES SURE	29.02	- 1	LENGTHS OF UMBILICAL	UMBIL IC	1	™ 25' —	.95	• ·
		Meter			1	Heter Temp.	Temp.	Vacuum	Stack				
•	7.5	(dry)			5 62	E u .		8 £ 1		Teno.	Temp.	Temp.	
1	70%	278.235	Jn. m20	5 X	400	Z7X	3 ×	E 0-	-	١		- H	Coments
	915	78.5		34	24	86	88	7	/		59		
	627	745.4		24	24	104	89	(2			26		
	0935	125.9		મૃત્	2.4	110	46	12	_	\	65		
	2460	1765.1		2.4	2,4	(/3	97	12			53		
	3560	1774.4	/	7.4	_አ ተረ	7.11	25	12			53		-
	909,	1782.1)	2.4	2.4	115	93	12			53		
	20101	791.8		2.4	2.4	160	101	17			53		
	5701	202.1		2-4	7-4	17	701	72			2/		
)E01	810.2		7-4	2.4	[13	103	۲,			<u>6</u> 5		
	Shot	819.8		2.4	7.4	118	B	12		-	47		
	7520	29.6		2.4	7.7	8/1	105	12			사		
	7011	938.4	_	7.4	2.4	619	105	12			45		
	XX	347.6		7-7	7.7	120	105	12			42		
	1125	1856 4		2.4	2.4	120	165	12	-	_	1//		
	1135	367.10		2.0	24	7	90	7		-	39		
16.64	ונפג נמניג		ORSAT				=	Inpinger No		Friel	Iniliah.	AL DIfference	ence
1 1		Rate CO.			П		1 1	2					
Gefore 17		0.003	 	1			1	~	 				
-							1 1	14					

LOCATION: ACTIVITY NO: 92(028 CONTROL BOX OPERATOR D. BLOAD PROBE IMMOLER CLEAN UP CLEAN UP Reading Velor (dry) Holer Control Time Cf	bia 1									MOT RO	HOT BOX NO. 1	
ACTIVITY NO: OF CONTROL BOX OPER PROBE NAVOLER CLEAN UP	2600	DATE	H	31-93		AHE:	1.82	3		Š		/
ACTIVITY NO: OF CONTROL BOX OPER PROBE NAMOLER CLEAN UP POINT Time	2600	TEST NO.:	NO.: N-5B	5B-0	-MIM-731	•	METER CORRECTION:	•	0.9649	1	COLD BOX NO.:	
CONTROL BOX OPER PROBE HAVIOLER CLEAN UP Point Time	17.048	MOZZLE:	Į			=	PITOT CORRECTION:	CTION:		PROBE NO.:	€::	
CLEAN UP CLEAN UP Point Time	LATOR D.R		STATIC PRESSURE PS:	E Ps:		9	TROL BOX	3万	22 Pm	CONTROL BOX NO .: Kgx 2, Particus FILTER NO .:	₩.:	
Ë			PORT DIRECTION:		1	2	MOMOGRAPH SET POINT:	ET POINT	<u> </u>	STACK DIA.:	DIA.:	1
<u>;</u>	(EARC	BARDPETRIC PRE	PRESSURE	29.03	1	LENGTHS OF UMBILICAL	UMBIL ICA	-	× 25.	. 85 ×	•.
Ę	Heter			-	Heter Temp.	dwa	Vacuum	Stack				
¥	(dry)		In. H20	<u> </u>	<u>.</u>	ŀ	J.É	į .~	Teno.		100 BOX	
-	C 27 42	- H20		+-	= [3 3	2	-	10	- /3. E	- H -	Coments
Ť.	335	1	10	7-	1	200	1 =			× 20 ×		
7	804.2		41	3	+	103				3/0		
忧	20%		7.4.7		ļ	108	1			37		
727	912. 4			2.4	23	108	1.1			38		
1235	921.2		24 2	, y [[23	148				38		
1245	126.1		5 h-2	17/17	12.7	108				38		
18.57 18.57	979.8		2412	2.4	20	108	tı			X		
V	938.4		2 h.c	2.4	121	801				39		
13/2	12:42		2 n 2	2.4	77	103				07		
1125	2.07			2.41	121	10.8				7,		
7335	6256	·	2.11	2.4	121	108				4(
15951	985.2		2.4 5		121	108				۸/		Sp. 10m2
1997	7			-							-	
125												
								د				
		ORSAL	, 1—1			三	Impinger No.	1	Front	Turlink	A Difference	ence
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	MACDITAL	THOMESTAL REPORTE, INC.			STAC	7	SIALK SAFFLING DAIN SHEET	- HE					
	PLANT: MIRES	Ohio	DATE:		7-31-93	>	¥	AHP: 1.821	17.		HOT B0	HOT BOX NO.:	\
LOCATION:)	TEST	TEST NO.: N	N-58-MM-	Mum -	731	METER CORRECTION:	:CT10N:	0,9649		COLD BOX NO.:	<i>.</i> .
ACTIVITY NO:		931023	M022LE:	ı)			PITOT CORRECTION:	:CT10M:		PROBE NO. :	₩0.:	
CONTROL	80 X OI	CONTROL BOX OPERATOR D. Romm.	1	STATIC PRESSURE PS:	SURE PS:		3	CONTROL BOX NO.:		B-Hand	B. Hand Sazrilter NO	. WO.:	
PROBE HANDLER	WIDLER		1	PORT DIRECTION:	38			NOMOGRAPH SET POINT:	SET POINT	ا نو	STACK DIA.:	DIA.:	
CLEAN UP			BARO	BARDHE TRIC F	PRESSURE	29.02	1	LENGTHS OF UMBILICAL	UMBIL IC	AL	7 .sz ×	8	•-
	ļ 	Meter Reading	Velocity	9112	e att	Meter Temp.	· dwa	Vacuum	Stack Temo.	Probe	9	Hot Box	
Point	<u>-</u>	(dry) CF	HD 1n. H ₂ 0	Feg. H.	H20 Act.	٥	Set.	- H			Temo. 1- °C/°F		Comments
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	11915	100C, 1		2.4	2.4	119	105				42		
_	1425	114.9		J.7	2.4	(20	106	11			74		
	经	024.0		7-7	ग -८	121	107	-			49		
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D-3: Anions Train (Method 26)

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KEYSTONE ENVIRONMENTAL RESOURCES, INC. AIR QUALITY ENGINEERING

SYSTEM OFFENATOR CA4 Davin's STEFN O. D-4 - FCL - 727 METER CORRECTION (T) PRODECTION (T) PROD	CLIENT	god	LO.		TEST DATE	E 7/2	2/22/93		EST DATE 7/27/93 DRY GAS ME	ETER NO.		
STE NO 25.64 4 CALIBRATION DATE	TEST UN	- 1	a		TEST NO.			2	METER CO	RECTION (2	
Reading STACK DIAMETER Reading Stack DIAMETER Reading Reading East Reading East Reading East Reading Reading East Reading East Reading East Reading East Reading R	PROJECT	NO.	N. Les		SITE NO.		4		CALIBRAT	ON DATE		
Comment Comm	SYSTEM	OPERATO	t d	יחיות	STACK DI	AMETER_						
Buck Reading Reading East Hot Box Impinger Probe Comment Maker Vectors Temp. T	DAROME	ETRIC PRE	SSURE		PORT DIR	ECTION _						
Fearling Fearling East Temp.	Traverse	匚	Dry Gas	Buck	Rolameter	Meter	Vacuum	Stack	Hot Box	Impinger	Probe	Comment
10	Point	Time	Meter	Reading	Reading	Exit		Temp.	Temp.	Temp.	Temp.	Kated Li
030 .49 .73 9/84 3 305 354 76/65 198 999 .72 1.7 9/84 3 305 250 75/66 200 990 .72 1.7 9/84 3 305 26 26 200 900 .73 1.7 9/86 4.5 306 26 363 75/67 197 100 .73 1.7 9/86 5.0 306 363 75/67 197 100 .73 1.7 9/87 5.5 308 253 76/67 197 101 102 103 103 103 103 103 103 103 103 103 103	(inches)		Keading (dcf)	(M 3@m/min)		Temp.	(in. Hg)	(F)	(F)	(F)	ي المراجعة المراجعة المراجعة	20
99975 1.9 39/84 3 305 254 76/65 198 49572 1.7 59/89 3 508 250 75/65 200 49572 1.7 59/89 3 505 26/55 200 80075 1.8 74/86 4.5 306 26.3 75/67 103 8073 1.7 81/86 5.0 306 26.3 75/67 103 8073 1.7 81/87 5.5 308 25.3 76/67 103 81 Impinger Impinger Final Initial Difference Impinger Final Impinger		11:30	894.030	bh:	.73							
99972 1.7 5789 3 308 250 75/66 200 4957/ 1.7 53/84 3 305 26/ 75/65 200 900 .725 1.8 94/86 5.0 306 363 75/67 197 10073 1.7 87/87 5.5 308 253 76/67 197 100 13 1.7 87/87 5.5 308 253 76/67 197 100		11:35		56.	1.9	18/66	٤	305	254		861	272
495 .71 1.7 53/84 3 305 361 75/65 200 800 .75 1.8 94/88 4.5 306 267 77/69 203 00 .725 1.7 91/86 5.0 306 363 75/67 197 100 .73 1.7 81/87 5.5 308 253 76/67 197 855 .73 1.7 81/87 5.5 308 253 76/67 197 855 .73 1.7 81/87 191/88 191		04:11	900.009	.72	1.7	68/65	5	808	250	\	827	272
800 .75 1.8 94/86 4.5 306 26.7 77/69 203 00 .725 1.7 91/86 5.0 306 36.3 76/67 197 100 .73 1.7 91/87 5.5 308 25.3 76/67 197 100 .73 1.7 91/87 5.5 308 25.3 76/67 197 100 .73 1.7 91/87 1.1 1mpinger 100 D. tot Padmy Impinger Final Initial Difference Impinger Final Initial Difference Impinger Imp		11:45	904.495	12.	1.7	68/cb	3	308	196		200	496
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AQE 7/92

			•			STACK SAMPLING DATA SHEET	LING	SATAS	HEET			·	Page [of	_
CLIENT	RATTER	BATTAIL 100E	•	TEST DAT	E 07-27	17 -93 (Tues		ORIFICE CORRECTION	ORRECT	10N /.572	7	HOT BOX NO.		1
TEST UNIT STACK	T 2/4	407	5,06	TEST NO.	CITE A	2-FCL-	727	METER CORRECTION CALIBRATION DATE	CRRECTI FION DA	10N/.0/5/ TE 72-93	M	PROBE NO. 4	5.4	•
CONTRO	L BOX 0	CONTROL BOX OPERATOR TE	$ \mathcal{E} $	STATIC PI	LESSUR	-10"140	ó	PITOT CORRECTION	RRECTIO	N COP		FILTER NO] .]	{ }
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Travens	1	Dry Gee	Pitot A P	3	Fice A H	Mater Te	Mater Temperature	Vacuum	ä	Probe	ing parties	Hot Box		
Į		Meter Reading	(F. 470)	Reg'd.	Act.	1 (£	₹ €	F. H.	įe	(F)	(CC*F)	E E		_
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	3 5		1,5	160	0.97	621	<i>[h]</i>	3.5	289				ایْ	
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SYSTEM	LEAK CHECK	RECK		PITOT LE	NK CHECK	15 Sec.	_	Inpies	Ĕ (Impieger		110	Difference	الو" چاچ
	Vacues	DOM Rete				Negative		<u>.</u>	CONTRACTOR INCOME	1 um /02 -	1619	546.3	73.0	20.7
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CLIEN	CLIENT Sodelle	11. DOS		TEST DA	ATE 7-2	17-93		ORIFICE	ORIFICE CORRECTION	/ N	X	HOT BOX NO.	} (
TEST C	NE CL	2		TEST NO.	N-58	£-171-	£7£	METER C	METER CORRECTION	O O	921	COLD BOX NO	X NO.
CONTR	OL BOX	ATOR.	2	STATICP	PRESSIBE			PHOTO	CALIBRATION DATE	2-16	23	PROBE NO.	
BAROK	LETRIC P	งข	16.		RECTION			CONTROL	CONTROL BOX NO.	1 2	Perthase	STACK DIA	ا ا
Traverse	T Tag	Dry Gas	Pitot 4 P	ဂ	Orifice A H	Moter T	emperature	Vacante		Probe	Impinger	Hot Box	Confidents
		Mater Reading (del)	(F. H20)	Req'd. (is. H20)	Ast. (m. H20)	4 E	8 6	G. He	įE	į	Temp.	Temp	
1	500,	205.9R	1	200	2.6	102	hb	120	1	+	(olo)		3
	101/5	214.3		2.0	707	2	92	120		-	25	1	4
	720	222.7	_	2.0	2.0		101	0.81	+		7/2	+	
	1035	230.4	<u> </u>	2.0	2,0	211	707	0.8	+	T	~~	1	1035c De 11100
	7501	738.4		7.0	2.0	[[]	1057				52	<u></u>	4815,5164
	1055	246. O		N O	N	71	108	8.0			57	-	
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SYSTEM	LEAK CHECK	ECK.		PITOT LEA	LEAK CHECK			Impinger	<u>lupinec</u>			i	
	Vecuen	DOM Rate			Positive	Negative	ļ	No.	Contents		Final	Initial	Difference
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KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

الا الا 702 Estimates: 94 861 98 %H20= - **%** ₩ Respective Difference (F) 255 247 **65€** METER CORRECTION (Y) 69 8 £ (*) I Impinger Temp. 3 DRY GAS METER NO. CALIBRATION DATE 76/ Initial 4 85/ GRAMMING DATA SHEET Hot Box Final Temp. £ 238 298 239 348 25/ Temp. Stack (F) 320 36 mpinger Contents TEST DATE 7/24/13 (in. Hg) Vecuum 3.5 Temp. 08/58 STACK DIAMETER 94/80 mpinger Meter PORT DIRECTION SITE NO. 75-64 ģ 80/ 96/ /38 Reading A 04 m . (647 Commin) Cot Reading 705 7 5 Kat Panne 425 36.600 1024.48a 998.713 558.6401 Dry Gas Reading (dcf) H. te min) Meter 045.5 FYRITE MEASUREMENTS SYSTEM OPERATOR K SYSTEM LEAK CHECK PROJECT NO. N. ES DOF ESD (in. 11g) (Vecuum 10:05 9:30 9:20 10:30 Clock Time 9:15 ħ TEST UNIT Fraverse CLIENT Before (inches) Point Afer

486.80

AQE 7/92

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Run

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STACK SAMPLING DATA SHEET

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/ 1 ON	NO. #/	5-3]	1.132"	Comments			Sach Pur	12.1.01	3	1151		Relie	10 registed								Estimates:	MW-29.	%H20=		Difference	1270	-42,0	3.1	13,0		/STO	Maria Branda
HOT BOX NO.	COLD BOX NO.	PROBE NO.	FILTER NO.	STACK DIA. 132"	Hot Box	Temp	(F)	7.83~																		Taikie Taikie	541.4	56%	434.2	652.6		K EV	
٨	7	73			Impinger	Temp.	(*C/*F)	48×													:					Final	10734	14	437.3	2009		The state of the s	- ره
ORIFICE CORRECTION 1,572	10N / 0/5	TE 7-2-93	9	<u>س</u>	Probe	Temp.	£	7.83					:												H. F.	Contents	-/01/-	2/22		1		Velach = 72.3 Affect	9729
CORREC	ORRECT	TION DA	RRECTION	C BOX	Stack	Temp.	(£)	285	787	482	787	287	287	187	287	287	±82	288	288	288	282	289	062	290	29.0	ð	100-140	Bruch A	Broth	2,115		the street	- 1997 1299
ORIFICE	METER CORRECTION,	CALIBRATION DATE	PITOT CORRECTION	CONTROL BOX NO.	Vecuum		(in. 11g)	4.0	3.5	3.5	13.5	3.5	3.5	3.5	3,6	3.5	3.5	3,5	3.5	3,5	3.5	3.5	3.5	3,5	13.S	ž		2.	3,	4	•	>	
()	-2				Meter Temperature	35	(*F)	68	93	35	26	29	/0/	701	101	104	95)	(00)	401	407	<i>සූරා</i>	201	80/	8o <i>)</i>	90)		-				_	18%	= 288
	24-729	192	1.1.16.0		Mater Te	=	(F)	36	104	80/	///	114	118	17	8//	1.69	02/	12/	171	122	121	(22	122	177)	170							Tarkey = 116 %	(feet) = 2889
TE 7-29-93	N-5a - F	à	PRESSURE	KECTION A	Orifice & H	Act.	(in. 1120)	0.0 0.00	0.83	0.93	0.95	0,95	0,76	960	0,96	0.96	1.00	1.00	101	1.01	1.01	1.01	1.01	1.01	/0./	15.0	7.0	٥	28.0		det)
		1 "	SIALIC PR	DIKE DIKE	Orif	Req'd.	(in. 1120)	න ර	0,93	0.73	0.95	0.95	250	26.0	0.36	960	00.1	1.00	/07	107	/27	1.0/	/0"	1.01	/0./	C02	02	00	N2	148	51.82H	<u> </u>	
	اري	\ \ \	2	20	Pitot A P		(in. H2O)	ر ا	1.15	1.15	145	1.15	1.15	1.15	1.15	1.15	02.1	(.20	07/	(20	1.20	027	3;	$\langle w \rangle$	3				_	上をのり かんとう	" March	, i les	
CLIENT BAHILLE LAKE	4. Hot Side	7C 0 20- 0	BARONIES BOX OFERATOR ALP	ESSURE ZD.	Dry Gas	Meter Reading	(qcl)	861,279																	CEAR CHECK	Rato (cfm)	<0.02	0.00	بردن		,		<i>y</i> \
Bth	1 45°	NO.	TO CA	יו אור ני	Time			ट्यस	8	14	9	*	2	75	#	*	2	ž	0 5	3	8	1	5	2 4		i. Hg	5.0	5,0		AK CHEC	1	5	
CLIENT	TEST UN	CONTEC	PADONE	Thousand the second	Traverse	Point		39.(Ì											10.0	CEAK CITY		Before	After		PITOT LEAK CHECK /5 4CC	1.		
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Y ENGINEERING	
FAL RESOURCES / AIR QUALITY ENGINEERING	
CEYSTONE ENVIRONMENTAL RES	
KEYSTONE EN	

DATE 7-2 GG 3 ONIFICE CORRECTION (a H49) G72 HOT/COLD NO. NC 3 - E (1 - 7.2.9) METER CORRECTION (b) 0, G92 PROBE NO DIRECTION	10.05 TEST DATE 7-29-93 ORIFICE CORRECTION (±140) 1.0.94 10.08 NOTE 10. 1.0.94 1.						ST.	CK SAM	PLING	STACK SAMPLING DATA SHEET	EET				Page of
NOTICE STATIC PRESSURE	TEST NO. N. C. C. C. C. C. C. C.	CLIEN	r Settell	6 DOS		TEST DA	Щ	9-63		ORIFICE	CORRECT	ION (▲ H@		HOT/COLI	BOX NO.
Control Cont	Control Cont	TEST U	TING TING TING TING TING TING TING TING	0 (4)		NOZZI E		EU	729	CALIBRA	DRINECTION DATE	2 7	ਗ਼੶	FILTER NO	
10 10 10 10 10 10 10 10		TEST	REW D	DVAN'T			RESSURE			PITOT CO	RECTIO BOX NO		1	STACK DI	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
Mare feating Land	New Transfer New	Taylor I	Ties	Dr G		3	H V ea	Moter To	obsession.	Verse	Sect	Ш	Impinger	Hot Bor	
0910 4/4,082 — 2.0, 260049 42 90 17 — 58 — 64 0920 41.2.	0910 414.082 — 20 20 20 17 40 17 60 17 60 10 10 10 10 10 10 10 10 10 10 10 10 10			Mater Banding (def)	(ii. H20)	(F. F720)	1 .		ð E	(ie. Hc)	- (-)	Temp.	Temp.	Terap.	
0920 421.2 17 1.9 47 90 17 0920 421.2 1.5 1.5 1.9 47 90 17 0930 421.0 1.5 1.5 1.6 17 0940 421.0 2.0 2.0 10.3 66 17 0850 421.0 2.0 2.0 11.0 104 17 0850 421.0 2.0 2.0 1.0 1/3 104 17 0820 477.0 2.0 2.0 1/3 105 17 1020 477.3 2.0 2.0 1/4 105 17 1020 477.3 2.0 2.0 1/4 105 17 1020 477.3 2.0 2.0 1/4 105 17 1020 477.3 2.0 2.0 1/4 105 17 1020 477.3 2.0 2.0 1/4 105 17 1020 477.3 2.0 2.0 1/4 105 17 1020 477.3 2.0 2.0 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17 1020 1/4 105 17 1/4 105 17	0920 471.2 7 1.9 47 90 12 0930 438.6 7 1.9 47 90 12 0930 438.6 7 1.9 47 90 12 0930 438.6 7 1.0 10 10 10 10 10 10 1	1	╫┈	4/4.082	_	7.0	2000	3	16%	21			58		min./po
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10\times 47\tilde{2} \frac{2}{3} \] 2\tilde{0} 2\tilde{0} 14\tilde{1} 10\tilde{5} 17\tilde{5} 5\tilde{5} 14\tilde{0} 16\tilde{5} 17\tilde{5} 5\tilde{5} 17\tilde{5} 17\til	10\times 479: \$ 2.0 2.0	_	326	1.'		2.0	2.0	113	705	21			24		
ΨΨΟ Ψ 8.7. ΨSI 2.0 2.0 1μ4 μ65 17 55 LEAK CHECK PITOT LEAK CHECK Impinger Im	040 487.45 2.0 2.0 14 105 17 1 LEAK CHECK Prior Leak Check Impiger Impiger Impiger Vectors Vectors No. Contents 1. Contents Vectors O.Octor O.Aber 1. 1. About Cool 1. 1. 1. About Cool 3. 4. 4. About Cool 5. 4. 5.	<u> </u>	10%	479.3		۲ ن	٥. ۲	hli	105	17			5.5		
LEAK CHECK	LEAK CHECK PTOT LEAK CHECK Impired Imp		040	482.451		2.0	20	hll	701	13			55		
LEAK CHECK	LEAK CHECK							-							
Fig. Fig.	LEAK CHECK														
LEAK CHECK	LEAK CHECK														
EAK CHECK	LEAK CHECK		-												
LEAK CHECK Impinger Impinge	LEAK CHECK	-													
No. Negative Neg	LEAK CHECX											 			Estimates:
Second S	LEAK CHECK				_										MW-
LEAK CHECK	LEAK CHECK													_	% H2O−
Vaccount DGIM Rate Positive Negative No. Contents Final Initial (in. Hg) (efm) After 1. 2. 3. 2. 3. 4. 4. 4. 4. 4. 4. 4. 5. 6. 5. 6. 5. 6. 5. 6. 5. 6. 6. 5. 6.	Vaccount DOIM Rate Positive No. Contents (in. Hg) (effs) After 1. 2. (in. Hg) (effs) After 2. 3. (in. Hg) (effs) After 4. 4. (in. Hg) (effs) 0.0.0 3. 4. (in. Hg) (effs) 0.0.0 4. 4. (in. Hg) (in. Hg) (in. Hg) 4. 4. <t< td=""><td>SYSTEM</td><td></td><td>ECK</td><td></td><td>PITOT LEV</td><td>K CHECK</td><td></td><td></td><td>Impiager</td><td>Impi</td><td>y Con</td><td></td><td></td><td></td></t<>	SYSTEM		ECK		PITOT LEV	K CHECK			Impiager	Impi	y Con			
(ia. Hg) (cfm) Before 1. /5 0.000 Alber 0.00 1 2. 3. 0.000 0.000 4. 6. 0.00 0.000 0.	(ia. Hg) (cfm) Before After (AC) 0.000 OAS 1 2 OA 0.001 O2 O2 O2 O2 O2 O2 O2 O2 O2 O2 O2 O2 O2		┝	DOM Rate			Positive	Negative		Š.	2	2	Final	laizial	Difference
1/5 0.000 Alber 2. 3. 4. 4. 5. 5. 5. 5. 5. 5	1/5 0.000 0.00		F. H.			Before				-:					
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KEYSTONE ENVIRONMENTAL RESOURCES, INC. ALR QUALITY ENGINEERING

		(•			(hos	RCE SAIN	IPLING D	TRANSPINOB OF SOURCE SAMPLING DATA SHEET	Ŧ			
CLIENT		DOE			TEST DATE	E 7/2	6/43		DRY GAS METER NO.	ETER NO.			
TEST UNIT	117	ESP			TEST NO.	N-9-	Fa - 7	73631	METER CON	METER CORRECTION (Y)			
PROJECT NO.	T NO.	N. Lec			SITE NO.	Inch	4		CALIBRATION DATE	ON DATE			_
SYSTEM	SYSTEM OPERATOR	R (Cen	4 Cenne	3	STACK DIAMETER	AMETER	1						
BAROMI	BAROMETRIC PRESSURE	SSURE			PORT DIRECTION	ECTION							
Traverse	_	Dry Gas	1	-Buck	Rolameter	Meter	Vacuum	Stack	Hot Box	Impinger	Probe	Comments,	_
Point	Time			Keading	Reading	Exit		Temp.	Тетр.	Temp.	Temp.	F. 160 INH	
(inches)		(dcf)	(H. 1)	(min)		те тр. (*F)	(in. Hg)	(*F)	(. F)	(*F)	(*F)	(40)	
	9:15	83.800			2.	89/82	7	303	229	22/02	26/	133	11
	9:20	012.88	<u>,</u>	77	2.0	89/12	4	302	# 732	79/99	2/2	85/	1
	6:30	96.110		26	57	69//2	6	/08	235	99/59	245	381	$\overline{}$
	54:6	107.562		7.6	2.0	37/12	ک	202	252	19/19	265	207	
	00:01	118.014		78	1 6	94/12	9	302	557	85/29	275	3/6	1 -
	51:0	188	,	11		11/64	7	302	747	19/19	150	100	
		30, 221				23902			6				T
	85:0	137.876	•	75	7.0	73/72	7	302	249	79/89	265	207	1
	200	141.793											1
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												Estimates:	1 7
												MW-	
												%1120-	1
SYSTEM	7	ECK				Impinger	lmp	Impinger					ı
-	Vacuum	OZ / Fish				- <u>\$</u>	5	Contents	Final	Initial	Difference		
Before	/4 //	10											
After						ii							
			_			4.							
FYRITE	FYRITE MEASUREMENTS	MENTS				3.							
OAS	교	Run 2	. —.									-	
700 CO													
70													
3 2	1		_										
71													

D-73

AQE 1/92

STACK SAMPLING DATA SHEET	$V_{AB}E_{C}$ TEST DATE 7. 31-93 (54) ORIFICE CORRECTION 1.572 $E_{C}=\frac{167}{167}$ Side TEST NO. N^{2} -56- E_{CL} - 73 (METER CORRECTION 1.0/5/	É	19. SORT DIRECTION A CONTROL BOX NO. 3	Dry Gas Pitot a.P. Orifice a.H. Meter Temperature Vacroum Stack Probe Impinger	Mater Reading London Act.	(44) (a. H20) (a. H20) (b. H20) (c. H20	925,457 115 0.92 0.92 8.7 80 4.0	1/5 0.72 0.92 93 82 4.0 28(\	101 760 160	0.94 0.94, 103 89 4.5 283	57 16 501 460 480	1 0.94 0.84 108 93 4.5 284	1.15 0.94 0.94 109 94 4.5 2.83	975-332 1,15 0.94 101 94 4.0 284 C	1.15 0.94 0.94 107 95 4.0	1,15 10,95 10,95 10,8 95 4.0	1.15 0.95 0.75 110 75 4.0	0.4 0.65 111 20.01 3111	1.16 10.95 10.96 112 97 4.0 284	1115 0.95 113 98 4.0 284	1.15 0.95 0.95 1/3 98 4.0 284	11.15 0.95 0.95 (14) 99 4.0 2.84	1976,125 1.15 10.55 10.35 1/4 1 (00 14.0 1200)	CHECK PITOT LEAK CHECK /	100 Part 100 100 100 100 100 100 100 100 100 10	2 My Lin- Mart 575.8 567.8	3. Goody J 434.4	5.4/ 200	60,660 del	1.15 NO 19.5 N	H 17.4. 1 998 (Text) = 288° 250 = 46.7 %
	17. 196	`	BAROMETRIC PRESSURE 29.	Traverse Time Dry Gas	Ž	3	39.1 0906 925.457	1					*		CAST 945 732			60	- CW	(B)	<i>a.</i>	\$.€	ı	1048	SYSTEM LEAK CHECK		_	1, 5, 5,	900 1	11	_	AGE 2001 COMPANY IN STANK

K	EYSIC	ONE			STACI	SAPL	STACK SAMPLING DATA SHEET	SHEET					
P. MT.	Alder Ohie	Mile	DATE:	: 7-31	1-93		¥v	DHR: 1.975			HOT BOX NO. :	X NO.:	
LOCATION:	ä		TEST	TEST NO.: A	N-5B-FU-73	.FU-	. 1	METER CORRECTION:		992)	0000	COLD BOX NO.:	
ACTIVIT	ACTIVITY NO: 92/1/8	8717	NOZZLE:	,			_ 1	PITOT CORRECTION:	CT10N:	. {	PROBE NO.:	OZ	,
CONTROL	80X 0P	CONTROL BOX OPERATOR D. BOLL	• •	E	SSURE Ps:		8	CONTROL BOX NO.:	NO.: B	Pox / Part	Partian STILTER NO.:	NO.:	
PROBE HANDLER	WOLER .			PORT DIRECTION:				NOMOGRAPH SET POINT:	ET POINT	ı	STACK DIA.:	DIA.:	i
CLEAN UP	1		EARO	BARDIETRIC P	PRESSURE	7000	1	LENGTHS OF UMBILLICAL	UMBIL ICA	1	× 25'	, 95 ×	•
		Reading	Velocity	9:15	Ho a	Heter Temp.	. Owe	Vacuum	Stack Temo.	Probe	Ino.	Hot Box	
Point		(dry)	#0 fn. #50	In. H20 Red. Act.	() () ()	-	Out.	÷.)- 0 	Temp.	Temp. 1, "C/*F	Temp.	Comments
1	2060	10.20. 482		74	2.4	18	DX	15		-	6 5		- Mac A
	09/5	1028.4		20	20		80	15		_	79		2.0
	500	633.3		2.0	2.0	7	82	17			54		
	7835	(042.6		200	2.0.	186	26	15			50		
	5460			2-0	20		28	£1			20		
	7586	5.85%		20	2.0	102	11	71			50		
	5001			2.0	20	103	31	4)			22		
	701	45.4		2.0	20	104	95	17			49		
-	7601			2.0	2.0	501	97	#1			45		
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EAK	LEAK CHECK		ORSAT	3			티	Impinger No		Ficial	Juiliak	ink Difference	PACE
	in Hg	• •		-			1 1	~					
Before	<u>د</u> و	G & Z & Z		 	1 7		1 1	,					
Arter			- - - -	-	 -		1	4					
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D-4: Ammonia Train

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KEYSTONE ENVIRONMENTAL RESOURCES, INC. AIR QUALITY ENGINEERING

F.16 5.14 (ok) Estimates: 192 120 %1120-M W Temp. Difference E) 247 295 METER CORRECTION (Y) Impinger DRY GAS METER NO. CALIBRATION DATE Initial Temp. (F) AMERICAN SOURCE SAMPLING DATA SHEET Hot Box Temp. Fig 3 Stack Temp. E) > Impinger Contents TEST NO. N-4-NN4-727 (in. Hg) Vacuum 7-17-93 2 Impinger بخ PORT DIRECTION STACK DIAMETER Meler Temp. 68 EX: 183 ŝ 116 10 1 TEST DATE SITE NO. _ Rolameter Reading Ø V 4 */min) 4 66 23 Connu 972.950 SCC 186 984. 90S Rate (min) Reading Dry Gas Meter (dcl) ś 2/5 BAROMETRIC PRESSURE 11/100 SYSTEM LEAK CHECK SYSTEM OPERATOR_ DOE (in Ale) Vacuum 60.5 Clork 6:20 Time PROJECT NO. TEST UNIT Traverse (inches) 34 TJK Before Point Affer 536

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JENTS	Run 2				
FYRITE MEASUREMENTS	Run I				
FYRITEN	SYO	CO3	70	00	N2

AQE 7/92

CLIENT BATTELLE 100.T TEST UNIT 5.75 cf. 40.7546 PROJECT NO. 93 cf. 98-9 CONTROL BOX OPERATOR 3/8 BAROMETRIC PRESSURE 29.00 Trevers Time Dy One Protein (include) Trevers Time Dy One Protein (include) (i	24.c 40.c 40		· [-] 이렇게 같니? [SIZE, D. 02-27-93 SIZE, D. 092- SIZE, SIZE SIZE, D. 092- SIZE, D. 092- S	12 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	25 17 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	METER CORRECTION CALIBRATION DATE CALIBRATION DATE CONTROL BOX NO. 3 Vocusin 1 tong. 17 (ii. Hg) ('f) 3.0 29/ 3.0 29/ 3.0 29/ 3.0 29/ 3.0 29/ 3.0 29/ 3.0 29/ 3.0 29/ 3.0 29/ 3.0 29/ 3.0 29/ 3.0 29/	SMECTION DATE OF TON BACK NO. 1904 N.	10N 1.572 10N 1.451 1E 7-2-93 N 0.04	2 2 3	HOT BOX NO. COLD BOX NO. PROBE NO. 5-	NO. Z. KNO. Z. S.
	#673.46 108 -8 / 6 / 6 / 6 / 6 / 6 / 6 / 6 / 6 / 6 /		1EST NO. 402ZLE (S) 17ATIC PRU ONING (O. 2. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	12E.9 0. 12E.9 0. ESSURE CTION (6. H29) (6. H29) (6. H29) (6. H29) (6. H29) (6. H29) (6. H29) (7. O.2. (7. O.2. (7. O.2. (7. O.2. (7. O.2.) (7. O.2.)	ラー・ファクラガー 一事たるこ	127 127 127 127 127 127 127 127 127 127	METER O CALIBRA PITOT CO CONTROL 3.0 3.0 3.0 3.0	SECTION DATECTION · rom	43	PROBE NO FILTER N	3 K	
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	7.98 27.0 (c) 2.43 (c) (c) (c) (c) (c) (c) (c) (c) (c) (c)		1.02 1.02 1.02 1.02 1.02 1.02 1.02	CTION A	30 27 20 27 1	\$ E F F F F E E 3 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	CONTROL CONTRO	BOX NO	TO PO			
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SYSTEM LEAK CHECK			PITOT LEAK CHECK	1 7	15 Sec.		lapinger	Impiager	100	i	•	A-54
Vacuum	DOM Rate			Positive	Negative	•	χ.	Coefee	cento			
	(c(m)	<u> </u>	Before	OK	OK C	•	-	Wat alk	BY N	507.1	0.7%	23.1
Before 5.0 O.	0.000	لــــا	A Sec				2.	10 July 107	14 1550	564.7	560.2	32 9. 4
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		<u>. </u>		39.0							¥ سا	KEYSTONE
AQE 2/97		ļ	2/20	1 4	on autient o	ંતુ					لا	THE REAL PROPERTY.
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	ENT PAR	1/6 Des		TEST DATE	E ナン	7-93		ORIFICE CORRECTION	CORRECT	7	975	HOT BOX NO.	NO.	
TES	T INIT	TEST UNIT CIS		TEST NO.	N-5B		727	METER CORRECTION	ORRECT	j	1266	COLD BOX NO	X NO.	
200	JECT NO.	9400A8		NOZZLE (SIZE,)	SIZE,	, ,		CALIBRATION DATE	TON DA	TE 7-16	-93	PROBE NO	0.	
00	TROL BOX	K OPERATOR D.	Typis.	STATIC PRESSURE	RESSURE	1		PITOT CORRECTION	RRECTIC	1	- 1		0.	
BAR	OMETRIC	BAROMETRIC PRESSURE 28	Ъ6	PORT DIRECTION	ECTION			CONTROL BOX NO.	BOX NC). Bex 2	Pullar	2	\ \ \ \ 'Y	
	Traverse Time	5 Dry Gas	Pilot & P	P	Orifice A H	Moter Te	mperature	Vacuum	Stack	Probe	Impirater	Hot Box	Comments	
Point	·	<u> </u>	(ie. H20)	Req'd. (is. H20)	Act (is. H20)	(<u>(</u>	8 E	Gr. Hg		Temp. (*F)	Temp. (*CV*F)	Temp. (*F)		
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	17.06	1		2.0	2.0	133	111	310			57			
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SYST	SYSTEM LEAK CHECK	СНЕСК		PITOT LEAK	K CHECK			Impinger		Impinger	ì		į	
L	Vacuum	in DOM Rate			Positive	Negative		Š.	3	Contents	.	lagia	Difference	
	(ii. Hg.	(2(3)		Before				-						
Before	┿	٦		After				7.		•				
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AQE 2/92	293												NETSIGNE	4.

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KEYSTONE ENVIRONMENTAL RESOURCES, INC. AIR QUALITY ENGINEERING

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	706			EFA MELHOD 26 SOURCE SAMPLING DATA SHEET	700 97 C	JECE SAN	The Inc	ATA SHEE	T.		
TEST		0		TEST DATE 7-24-13	E	27		DRY GAS METER NO.	IETER NO.		
DEST UNIT	1			TEST NO.	N-4-1	121-PHN		METER CO	METER CORRECTION (Y)	3	
PROJECT NO.	NO.			SITE NO.	Inter	4		CALIBRATION DATE	ON DATE		
SYSIEM	SYSTEM OPERATOR		Contra	STACK DIAMETER	AMETER						
BAROM	Ξ.	SSURE		PORT DIRECTION	ECTION _						
Traverse	_	Dry Gas	F/OS PER	Rotameter	Meter	Vacuum	Stack	Hot Box	mpinger	Proto	Comments
Point	Time	Meter	each Residting	Reading	畫		Temp.	Temp.	Temp.	Temp	F1/4-5. 44
(inches)		(def)	Mr calin			, no.	į		ار بعدر	Tresta Inc	
	91:11	CW/ 7/101	1		10/10	(111. 118)			∠ ∥`	£ .	
	2	20.00			14/12		505	3/2	28/83	265	55
	1:15	1048.161	.75	5-	18/18	5	305	219	_	263	189
	11:15	1049.835	.75	1.5	18/63	א	305	1331	09/44	263	961
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11:35	a	1057.148	,76	6.1	18/26	5	305	247	-	200	100
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SYSTEM	┙Ĺ	ECK			Impinger	lmp	lmpinger				
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Before	, V	9/0	-		7						,
After											
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FYRITE	FYRITE MEASUREMENTS	MENTS		-	4						
GAS	Run	Run 2						· · · · · · · · · · · · · · · · · · ·			-
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AQE 7/92

STACK SAMPLING DATA SHEET

ORIFICE CORRECTION 1,672 METER CORRECTION 1,0/5/ CALIBRATION DATE 7,2-43 PROBE NO. 2-1 PROBE	Contents Final Initial Difference Contents Final Initial Difference Contents	--	--
1.572 1.0/5 7.2-9 3 0.84 Impinger Temp. (°F) (°C/°F) 389- (689°F) 389- (689°	Find In 508.8 48 2567.3 390.6 67.3 390.6 67.3		
1.55.7 1.00.90 1.00 1.00 1.00 1.00 1.00 1.00 1.	(400 m)		
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(in. 11g) Vector (in. 11g) Z.5. Z	1100		
	No. 1. 2. 1. 3. 3. 5. 6. 5. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6.		
7.0. Mader Temperature In Out ('F) ('F) ('F) ('F) ('F) ('F) ('F) ('F) ('F) ('F) ('F)			
(4, 1) (
(SIZE, M59-73 (SIZE, M. O. 1828) O. 1888 SURE - 188	- 127. Ox		
TEST DATE 7-29 TEST NO. 1-50. NOZZLE (SIZE, M) STATIC PRESSURE PORT DIRECTION Onigne AH Roy d. Act. (in. 1120) O.97 O.97 O.97 O.97 O.97 O.97 O.97 O.97	20 00 E		
4 0 0 0 0			
3/2 mm = 10 mm	Rate (cfm)		
THE PROPERTY OF THE PROPERTY O	CHECK O O H		
CLIENT BAR PROJECT NO. CONTROL BO BAROMETRIC Traverse Tim Point & S. 1/25 1/25	Before 5 NACT LEAK ANGT SON N		

Page of /	BOX NO.			Сопинения		min./point		•								Estimatet:	X.W	\$H20=	. 1	Difference					4 OF 6/82	7 6 1 7 Y
	75 HOT/COLD BOX NO.	FILTER NO	STACK DIA PORT SIZE	Hat Box	Тепр. (*F)														 	latinal Latinal	-				 	
BERING	24.0	93	Partland	Impiage	Termp.															Fish						
KEYSTONB ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINBERING STACK SAMPLING DATA SHBET	ORIFICE CORRECTION (AHD)	و		II .	八下南江	59	53	53	53										<u>.</u>	a de la companya de l						
QUALIT BET	CORRECT	TION DA	CONTROL BOX NO.	Stack	Temp. (*F)	1													frapiage	Content						
S / AIR ATA SH	ORIFICE (CALIBRATION DATE 7-	CONTROL BOX NO.	Vectores	(in. Hg)	3.0	3.0	3.0	3.0										(mpinge	χ.	:	7		•	! !	
SOURCE PLING D	4	± 4 5		persture	\$ E	104	103	5 01	107											•					'	
MENTAL RESOURCES / AIR QU/ STACK SAMPLING DATA SHEET	7-29-93	7		Meter Ten	4 (°)	163	122	122	123											Negativa		7	7			
RONME!	·	E (SIZE,A)	PRESSURE	office A H	(in. H20)	2.5	2.5	ンド	2.5									-	BAK CHECK	Positive		1	_			
NB ENVI	TEST DATE	NOZZLE (STATIC PRESSUR PORT DIRECTION	8	F ES	2.5	レイ	7.5	2.5			-							PITOT LEA		Before	After	8	3 8	8	ZZ
KEYSTO			3.8	4	(is. H20)	1	/												-,				_	 -	<u> </u>	_
	2005	270)-	ESSURE 28		Men Parting (def)	487.837	75%.8	M.Call	574.531										ECK	DOM Rate	(cfm)	0.001	1000			
	CLIENT BAHELL I	T NO. 73	TEST CREW D BLOWE BAROMETRIC PRESSURE	Time.		1055	ンのニ	ン 	1135										LEAK CHECK	Vacens	(in. Hg)	15	12			
	CLIENT	PROJECT NO	TEST CREW BAROMETR	Travers	Pois de la constante de la constante de la constante de la con								-					-	SYSTEM			Pefor	Affec			

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KEYSTONE ENVIRONMENTAL RESOURCES, INC. AIR QUALITY ENGINEERING

PEPA METHOD 26 SOURCE SAMPLING DATA SHEET

Estimates: (o F) %H20= 8 18% 196 70 ¥₩ Tempino (no Difference 265 264 7 METER CORRECTION (Y) CALIBRATION DATE Impinger DRY GAS METER NO. Temp. 3 Hot Box Final Temp. 9 926 232 746 20 303 8 Stack Temp. (F) Impinger Contents (in. Hg) Vacuum TEST DATE $\sqrt{34}$ Impinger STACK DIAMETER 77/74 Meter 74 SITE NO. Fales PORT DIRECTION Temp. (*F) Exit ŝ Rotameter Reading 1 d C Reading 96 .75 SYSTEM OPERATOR Kent Penne 150.652 13.635 42 4C Meter Reading (dcf) (Trad/min) Dry Gas 154.31 **FYRITE MEASUREMENTS BAROMETRIC PRESSURE** عهارم SYSTEM LEAK CHECK 630 DOF (in. 11g) Vecuum 64:11 Clock Time 11:14 Frog PROJECT NO. TEST UNIT Traverse (inches) Before Point After (e:11

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Run 2

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CLIENT 2	le le			TEST DAT	<u>, 199</u> je	STACK SAMPLING DATA SHEET (7-31-93) (S.4.) ORIFICE CORREC	PLING	DATA	OATA SHEET ORIFICE CORRECTION	TION 1/5	7	HOT BOX NO	Page 1 of /
PROJECT NO.	シマン	3CG 28-6/	, K	NOZZLE ((SIZE,A)	102 C	53/	CALIBRA	CALIBRATION DATE	!	J. F.	PROBE NO.	X NO. 2
AROMETA	BAROMETRIC PRESSURE	12	8	PORT DIRECTION	ECTION		2	CONTRO	CONTROL BOX NO.	S C C		STACK DIA.	O. A. (32."
	Time	Dry Ose	Pitot A P	ક	fice A H	Mater Tea	traperature	Vacoum	T T	Pate	Impiage	Hot Box	11
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X	XX	EYSTONE			STACI	SAMPL	STACK SAMPLING DATA SHEET	SHEET					
	Miles	Olaid	DATE:	7-	31-93		V	6HP: 1.9	1.975		HOT BOX NO. :	C NO.:	
LOCATION:		-/	TEST	TEST NO.: 1	N-58-NHV-73	MY	_1	METER CORRECTION:	CT10N: _	0992	COLD BOX NO. :	0x 86.:	\
ACTIVITY NO:		13(078	MOZZLE:				ļ	PITOT CORRECTION:	CT10N:		PROBE NO.:	9.:	
CONTROL	80x 0P	CONTROL BOX OPERATOR D. BARNA		IC PRES	STATIC PRESSURE PS:		ຮ	HTROL BOX	10 分	2x L Za	CONTROL BOX NO.: BOX Both of ILTER NO.:	Ož	\ .
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CLEAN UP			BARO	BAROPE TRIC F	PRESSURE	2902		LENGTHS OF UMBILICAL	UMB IL ICA	-	× 25.	S	• •
		Meter Reading	Velocity	Orific	HO H	Meter Temp.,	eno	Vacuum	Stack Temp.	Probe	- de	Hot Box	
Point	Time	(d y	±0 ±a. ∺,0	Reo. H	Act.	-	2	. ₽			1. C/°F	. T	Comments
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I FAK	FAK CHFCK	, See	ORSAT] ~				Impinger No.		From	Iniliak	AL Difference	ence
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KEYSTONE ENVIRONMENTAL RESOURCES, INC. AIR QUALITY ENGINEERING

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FILE ELLY 209 202 202 σ ĺ٧ Temp. Heated Live E 249 8 H 8 247 グング METER CORRECTION (Y) 74 Impinger Temp. DRY DAS METER: 3. CALIBRATION DATE (F) B **LETHIOP AL** SOURCE SAMPLING DATA SHEET Hot Box Temp. 296 242 (F.F.) 256 369 Stack Temp. (F) 210 35 2 118 -727 Vacuum (in. Hg) 2.0 2.5 7/27/93 TEST NO. 1-9-CF 93/90 SITE NO. Inkt STACK DIAMETER 68/16 95/69 Exit Temp. 75/89 68/18 Meter PORT DIRECTION E TEST DATE_ Rot: meter Reading 101 Ø $\boldsymbol{\omega}$ Resto Beading 256 73 Kent Rennie 955.53**8** 966.776 68 972.317 98 33 S Dry Gas Meter Reading 973.52 Gen BAROMETRIC PRESSURE 95/ Niles SYSTEM OPERATOR__ DOE 417 2 14:30 4.20 7.7 51:61 Clock Time PROJECT NO. TEST UNIT Traverse CLIENT (inches) Point 732

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FYRITE MEASUREMENTS

					STACI	K SAME	PLING 1	STACK SAMPLING DATA SHEET	HEET				Page / of /
CLIENT	Bothelle	100%		TEST DAT	re 67	127-27-93 (Led	_	ORIFICE CORRECTION	ORRECTI	- 1		HOT BOX NO.	to. 7
TEST UNIT	NT STREET	PIS JOH - SIAK	95	TEST NO.	A 5a-	-CN-	±7£	METER C	METER CORRECTION CALIBRATION DATE	1.05	- ie	PROBE NO. 4	NO. N.
CONTRO	CONTROL BOX OPERATOR		25	STATIC PRESSURE	RESSURE	-1.07/20	Q	РІТОТ СО	PITOT CORRECTION	lo l		FILTER NO.	'
BAROM	BAROMETRIC PRESSURE	29	90	PORT DIRECTION	ECTION	Ł		CONINC	CONTROL BOX NO.	[]]		SIACE DI	Ш
Traverse	Tiles	Dry Gee	Pitot A.P	P	Orifice AH	Mater Tem		Vector	¥,	Property (Hot Box	Comments
		Mater Reading	(je. H20)	Reg'd. (is. H20)	Act. (is. H20)	. (f)	8 E	GH.	E	Temp. (*F)	(*C/*F)		
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			(.25	8	90%	421	511	3.0	7				130e Lone
	2.4		125	901	90./	621	//5	3.0	292				Smolera Fire
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	128		1.25	90%	0,0%	(30	±11	30	293				
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	13.0		027	1.02	701	131	17	3.0	283		!		
	/3/2/		1.25	90%	10%	/3/	#11	3,0	292-	i			
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Column C	EST UN	INO O	2002		TEST NO NOZZLE	N-N-	-12	£2.	CALIBRA	ORRECT TION DA	1 7117	126	COLD BO	X NO.	
Time Day Gas Pad 2 P Orifice A H More Tamporations Vaccores Finds Pade	ONTRO	L BOX C	PERATOR	Pare -	STATIC PORT DIN	RESSURE	\\\		PITOT CC	BOX N]) 1 	1 1		
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(a. Hg) (cfm) Before 1. 1. 2. 3. 5. C. C.C.C. C. C.C.C. C. C.C.C.C. C. C.C.C.C. C.	- 1	LEAK CH	ECK.	_	MIOI LEA	A CHECK	Managhan	_	III De la Constantina del Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Constantina de la Cons	<u> </u>		1	- field	Difference	
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						Profes	Temp, C.	_	(*F)		31 596	61 690	263 2	270						Estin	MW=	2118		Difference				
_	ETER NO.	METER CORRECTION (Y)	N DATE			- tempringer			£ (.E)4	08/98	29	63	19 /39	85/04										Initial				
SOURCE SAMPLING DAIA SHEEL	DRY GAS METER NO.	METER COR	CALIBRATION DATE			Hot Box	Temp.		(F)			996	273	350										Final				
MPLINGL		ļ				Stack	Temp.		(F)	305	305	305	30%	285			 						Impinger	Contents				
としていると	Z.	N-739				Vacuum			(in. Hg)		3	(4	5	4									m lm	ပ				
	TEST DATE 7/29/98	TEST NO. N-4-CN-729	SITE NO. 7-14 9	AMETER	ECTION _	Meter	1	Тетр.	₹(•F)£	19/08	18/16	18/58	18/38	87/82									Impinger	Š.	- -i	5	-	•
OU FORM	TEST DAT	TEST NO.	SITE NO.	STACK DIAMETER	PORT DIRECTION	Betatteler	Reading	Memb			6.7	6.1	1.9															
)÷		•		S Buck	Parto Reading		(cc/min)		91.	554.	.76	.73		 												
		ď.	les	1 Kent Ponnie	1	Dry Gas Prom		Reading	(dcl)	59.100	169.09	62.905	10.398	97.279	87.095								CK	Ryle Ryle	Hac/min)	.03		
(DOE	T & 5.50		SYSTEM OPERATOR	NAROMETRIC PRESSURE	Clock	Time			11:55	25.1		12:10	ł .	End								SYSTEM LEAK CHECK		(in. 11g)	7		
	CLIENT	TEST UNIT	PROJECT NO.	SYSTEM	NAROME	Traverse	Point		(inches)		1157												SYSTEM			Before	After	
	J			V	_	<u> </u>		••••			-			<u></u>	<u> </u>	<u> </u>	<u> </u>	·	 	ئــــ	!		ا ب - ا		_)

FYRITE MEASUREMENTS

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Run 2

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	HOT BOX NO. COLD BOX NO. PROBE NO. 5-3 FILTER NO. 5-3	Hot Box	Temp.	2022																	•		50,00	17/55	447.6	00015	7 2
	43	Impinger	Temp.	160%	100														7			Figs	1	5/06/	450	22/2	
	125 17 Pm	Probe	Temp.	7.0.	~610 €)	- 289		Impinger	Contents	100-10,1m 100#	10.(M/10)		200	
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		Meter Temperature	Out		7	107	801	407	301	90/	801	60/	601	109	1091				- 1/4th	1 1							
STACK SAMPLING DATA SHEET	CN-729	Meter Te	.		01/7	1/6	12/	72/	/22	122	(23	122	(23	527	123				()、		7						
SIACE	1 2 - 29 - 62 - 62 - 62 - 62 - 62 - 62 -		Act.	(in. H20)	100	1000	460	46.0	6.97	760	297	0.97	260	250	0.97				098		-	15.0	2.0	0	78'D	72.3 Flee	00 60 60
	TEST DATE TEST NO. A NOZZLE (SIZ STATIC PRE	H A Solifee	Req'd.	(m. 1120)	707	10/	46.0	400	6,97	260	260	460	75.0	-	1				(14)	*		C02	02	8	22	h	١
			<u> </u>	(is. H2O)	027	7.20	1/2	\v'.	1/2	(15	11/	1/2/	1/2	1//	1/5				- (01)	20						4.101.10	
	16 25 2.16- Hot 5.46 976,018-01 COPERATOR J	Source Car Go	Meter Reading	(40)	630.530											665.672			411/20	D= 30.70c		Rate (cfm)	5000	2000		K 55kc	
	Hotelle NO 972	I NIC T NE	Ĕ	,,	11 406	Ç	9	8	8 %		,	,	3 _		a	1240	1			02-100	CHECK	F. E.	, X	100	2	PITOT LEAK CHECK KSAL	NEO.
	CLIENT Refe / LASTES THE STATE OF STATES OF THE STATES OF	BANOME I RIC TRESSONE	Point	•	31.																I EAK CIT	5	Refore	Y		PITOT LE	203

Page of	HOT/COLD BOX NO.	FILTER NO. ——STACK DIA. ———	PORT SIZE	Hot Box Comments	Temp. (°F)	tain./point		•												-74.74	8H2O-		faitial Difference					AQE 6/92	
ERING	اما		PartlaniPol	\vdash	- (f.)	- 88	25	52	52	52	53	52							-				Fishel		+				
ITY ENGINE	CTION (+ H@)	NATE 7-16-9	Bock	Probe	Terap.		1 / 1												1	+		Impiage	Contracts						
NVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET	ORIFICE CORRECTION (* H@) METER CORRECTION (Y) 0, 94	CALIBRATION DATE 7216-93	CONTROL BOX NO.	Vacuum Stack	(in. Hg) (*F)	-	4.0	4.0	100	4.0	4.0	10.4			\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \				+	+		Impiager	₩.		2.	ri ·	* *		
RESOURCES MPLING DA	M PCZ-		0	Comporatore	A (F	 	102	801	1001	1.10	100	10/				}				+			<u>-</u>				<u>.</u>]) 	3
NMENTAL STACK SA	7-29-93		ON	Metae	Actord le (e. 1820) (°F)	h// h	4211	1	18/ h		181 h	.4 131		-					-	1	-	BCK	Positive Negative	╁┤		1			}
NE ENVIRO	TEST DATE	NOZZLE (SIZE,)	ORT DIRECT	Orifice 4 H	Required Actors (b. H20)	{} -	 		2 72		2-4 2-4	-		-			-			+		PITOT LEAK CHBCK	-	Before	After		8 8	8 2	146 1
KEYSTONE E			3.38		(F. H20)	<u>ارا</u>						-		-	-					+	-		<u></u>		<u> </u>	, 	—- 	- ₩₩-	J
	300 3	93,028	RESSURE 2	Dy Ge	Mater Reading (dcf)	12	0	_	8.1h.7	こんなし	0 558 9	0 KI. X 30	7777			1	-			-		HECK	AND BAR		1-1	C00.0			
	CLIENT BATELLE	PROJECT NO.	BAROMETRIC PRESSURE	Traverse Time	Point inches	OMI	11/20	ACO	017	7	4 -	וש כו	2					-				EVETEN LEAK CHECK	•	S. H.S.	Before 15	H			

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KEYSTONE ENVIRONMENTAL RESOURCES, INC. AIR QUALITY ENGINEERING

			₩	CEP.	METHO	D 26 SOU	RCE SAN	APLING D	EPA METHOD 26 SOURCE SAMPLING DATA SHEEF	ır		
CLIENT	8	11			TEST DAT	TEST DATE 7/3/193	1/93		DRY GAS METER NO.	LETER NO.		
TEST UNIT		E50			TEST NO.	N- 4	4- EN-731	73/	METER CO	METER CORRECTION (Y)	U	
PROJECT NO.	r NO.	NILES			SITE NO. Intet	Inter	7		CALIBRATION DATE	ION DATE_		
SYSTEM	SYSTEM OPERATOR	Part 1	Rennel		STACK DIAMETER	AMETER						
BAROME	BAROMETRIC PRESSURE	SSURE			PORT DIRECTION	ECTION _						
Traverse	L	Dry Gas	Flow Buck		Rotameter		Vacuum	Stack	Hot Box	Impinger	Probe	Comments
Point	Time	Meter	Park Reading	. E °	Reading	Exit		Temp.	Temp.	Temp.	Тетр.	
		Reading	Ċ			Temp.			,		,	
(inches)		(dcl)	14 toc/min)	iii)		(•F)	(in. Hg)	(F)	(F)	(F)	(F)	
	15:11	154.800										
	25:17		.77		7.7	94/86	ح	508	270	59/24	160	201
	95 ; 11	188.791			بز	26/82	٦	305	997	19/39	280	216
	10:0	162.705	17.		0.0	22/2	3.5	308	296	85/69	286	9/6
	2:1	170.365	.76		0.0	60/27	4.0	305	76/	\sim	279	3/6
	81:C	125.707			2.0	81/18	4.5	306	556	09/92	276	318
حد : دا	End	177.641										
												Estimates:
												-ww
												%H2O=
SYSTEM	SYSTEM LEAK CHECK	ECK				Impinger	յ ալ	Impinger				
	Vacuum	L. Ryle				ġ-	වී	Contents	Fine	Initial	Difference	r
9500		II + ma/min)	1			-						
Pelote	4	70.	_									
VIII			_								1	
4		4				; e						1
FYRITE	FYRITE MEASUREMENTS	KEZIN				<u>ن</u>						

Run 2

Run 1

2000 E

٥.	7					a dina			But	iche	14.6	74.		no creed	les A	2							::	7.5	7		27.49	2	100	0	をまるして	Marghar	9,3	KEYSTONE
Page	NO.	C NO.	6.5). 	V. (32.4	3			Sirk Sirk	Batric	Sapli	1,4		Racelons	5111			-					Estimates	MW-27	%H20-		1	Delere	77,	900	4.5		7	KEYS
	HOT BOX NO.	COLD BOX	PROBE NO	FILTER NO	STACK DIA	Hot Box	Torage	(F)	202-													-					•		1572.5	8.855	9,54,6	2000	1	
	ر د	/	3			- Indiagram	Temp.	(\$. E	<68°F															3682	•	8.8%			1621.7	8.995	450.6	16.2		
	1572 NO	1	6773	\$2.0 N	3	Probe		(F)	~2589														i	32-		- GS2	Impinger	Contents	O/M AND	O/MANA	000			
HEET	ORRECT	RRECTK	TON DAT	RRECTIO	BOX NO	Sect		E)	382	29.85	288	882	288	287	288	882	283	183	290	290				10.0		11/1/20	<u>a</u>	S	120	1 -1	To design	DE L		
STACK SAMPLING DATA SHEET	ORIFICE CORRECTION	METER CORRECTION	CALIBRATION DATE	PITOT CORRECTION	CONTROL BOX NO.	Vector		(is. Hg)	5%	40	4.0	4.0	4.0	4.0	4,0	4.0	4.0	4,0	40	4.0				7		7 = W	Impinger	No.	<u>-</u>	2	ć	* *		,
LING	_	3/		0		and and and	3	(F)	(0)	101	20	101	707	201	103	3	(0)	60/	401	104		,		£1169		Marty	7	•						
SAMP	75) 2		100	11/1		Mater Tomo	• 1	E	Go!	//3	1	115	1/1/	11/2	#11	160	411	8//	1/8	8/1				7	****		1881	Negative	Š	94	2			
STACK		ک∣د	: 2			1 2	3	(F. H20)	295	760	760	160	2,0	950	26,0	0.30	080	96.0	1 1	92,0				3603			K CHECK	Positive	2	谷	J — L	0.7	\$0 \$	79.5
	TEST DAT	TEST NO.	NO771 E	בי דוני ב	PORT DIR	3	7,70	Ē. 1	260	760	760	0.00	% 0	260	200	%	0.60	36.0	260	0.56				787	4		PITOT LE			Aber		8	8	2
		4	3 	*			Š	(JE H20)	1/2/	2/2	71.2	21/	116	2//	7/2		1/2	7/1	7/2					1 1		(1)		_			_			
	7		16	1000	MAIOR 70	Ш		Secondary (4-0)	20,100	000											101.50			1201	A-32-401	OCT		AND BALL	1 4 4		8000			
	11/11/2		766	PROJECT NO. 92/ 10 CZ	CONTROL BOX OPERATO	NA I NEW		I	+	07/	×	0	<u> </u>	3 '	7	9) <u>,</u>	9	\$	e \	1200 10	1			T	3	ו איני איני			3 (s	200	-		
	!	CLIENT AL	TEST UNIT	PROJECT	CONTRO	DAROME	Traverse		-	7.20																		STSIEM			After			

10. :- No. :- 10) .s. ×	Hot Box Temp. Ty °F Comments											,	Difference
HOT BOX NO.: COLD BOX NO. PROBE NO.:	x 25' x 5	lmp. Temp. 11 °C/°F	43	7/7	36	38	28		-		<u>}</u>			Latink
AHE: 1.925 METER CORRECTION: 0.992.) PITOT CORRECTION: CONTROL BOX NO.: Box 1 Purtlant	111	Probe Temp.	1		1			7	1					Fich
1.925 I.925 IRRECTION: BOX NO.: B	SET POIN	Stack Temp.	1		1		1	1	+	+	-	+	-	No.
AHE: 1.975 HETER CORRECTION: CONTROL BOX NO.:	NONGGRAPH SET POINT: LENGTHS OF UMBILICAL	Vacuum Va La.	WAZ	47	ur	7	4			_				Impinger 3
8 1 1	1 1	Meter Temp Tm Fm Fn Fn Fort	162	13	46	103	103) ===
STACK SAMPLING -31-93 N-518-CN-731 SSURE PS:	PRESSURE 29.02		901		122	} -	_	-				-		
DATE: 2-3[-9] TEST NO.: N-5[3-19] NOZZLE: STATIC PRESSURE Ps.:	IECTION: LIC PRESS	Orifice all in. H20 Reg. Act.		17	2	2.4 2.4	P-2 P-2	+	1			+		
DATE: _ TEST NO NOZZLE: STATIC	PORT DIRECTION: BARDNE TRIC PRES	Velocity Or HD 11.		2.4	2.4	1	7	+	+	+		+	 	ORSAI
KEYSTONE PLANT: Milec, Oldeo LOCATION: 93-0013 CONTROL BOX OPERATOR P. Brace-		Heter Reading (dry) CF	-	4.04.6	749.3	766.8	116.544			1				Rate 00.000 0 00.000 00
KEYST PLANT: MILEC LOCATION: C ACTIVITY NO: C CONTROL BOX OPE	PROBE HANDLER	1.50		સ	13.30	1256	1,700							LEAK CHECK
PLANT: A LOCATION: ACTIVITY I	PROBE NA	Point								+			-	Before After

D-6: Aldehyde Trains

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KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

Commente Estimates: %I120= Difference Probe Temp. (F) N - 1 - ALD - METER CORRECTION (Y) CALIBRATION DATE Initial Te Tay J METHOR & SOURCE SAMPLING DATA SHEET Hot Box 720 Temp. Final 757 255 £ 234 240 231 Stack Temp. (F.) Contents mpinger (in. Hg) Vecuum Ч 4 Y ч 4 3 7/24/93 TEST NO. Talet 4 Impinger SITE NO. Third Meler Temp. PORT DIRECTION Exi (F) ģ TEST DATE_ Rolameter 27.50 Reading 20 8 56 800/min) 09 9 88 03. Can Rennie व Reading 710.50 Dry Gas 767.88 706.20 748.75 708.03 735.91 Meter 765.5 (def) DAROMETRIC PRESSURE PROJECT NO. NIKE SYSTEM OPERATOR_ SYSTEM LEAK CHECK DOE 17132 10:07 7135 17:30 <u>s</u> Clock Time 18:31 **TEST UNIT** Traverse (inches) Point

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AQE 1/92

tage 191

† }	1 1.	11			1.	1	ঠা	J				ì				\	1	1	1	ļ	Ì	}					4,	<u> </u>	<u>`</u>	
NO.	5.5	, , , , ,	Comments		7.27	u N	Marietane	Sanding for	1 1841 0	2. Lfmila.											MW=29.3	%H20= 9	į	Dullerence	0.7.	= 1.3	٥٥			YSION E
HOT BOX NO.	FILTER NO	SIACK DIA.	Hot Box	(eff.)	1,000	180																			96.5	93.7	200	11.6	7	
			Impinger	Lemp.	1	4687															250			Final	94.5	27.4	29.50	3		
6,0	E 6-74-73	CONTROL BOX NO. DEM USB6553	Probe	Cmp.		7022v), = 3		age c	leats	butter.	7474	0,	XX		
ORRECTION	ION DATE	BOX NO.	Stack	d (307	363	383	83	183	383	328	303	303.	304	304	30%	304			1/2/		Impinger	Content	2000	200ch	Z in			
ORIFICE CORRECTION METER CORRECTION	CALIBRATION DATE PITOT CORRECTION	CONTROL	Vacuum	;	E . E		00	9	o o	0,0	0.0	Ο̈́O	0.0	0.0	0,0	0,0	0,0	0,0			246		Smpinger	Š	-	2.	3	*		
			pereture	3		97	97	97	97	97	44	97	97	26	16	10	76	98	}		11									
5- 426	04,01		Meter Temperature	.E	5	2	4	40	45	46	25	76	76	16	40	O O	46	96	1	,	1		7							
E 7-26-93	2	ECTION A	Orifice 4 H	Act.	(in. 1120)	new 1064																	-	1221	14/	0	7%0			
TEST DATE		PORT DIRE	Orig	Roq'd.	(in. 1120)	25 00													-					200	3 8	8	ZZ			
		00	Pilot A P	l.——	(in. H20)																			,						
100	PROJECT NO. 03C028-0/	SSURE 29.	Dry Gee	Meter Reading	(dcl)	29/6.720												1000				4		3	Kele (CD)	- <u> </u>		×		
Ratelle 17 Sack	NO ON	TRIC PRE	Time			1720	77.5	1720	72.5	1450	7/1/2	7,5	Ä	46		23.00	0/23	S	ma			<u>a</u> l.	4	CHECK	ii.	9,4	2	PITOT LEAK CHECK	NEG.	
CLIENT Extelle	PROJECT NO.	BAROME	Traverse	Point		50,00	*																	LEAK		Before	Ş İ	PITOT L	20.5	

50			Difference KEYSTONE
		Etimates: MW- SH20-	Difference 7-7-7-7-7-7-7-7-7-7-7-7-7-7-7-7-7-7-7-
Page HOT BOX NO. COLD BOX NO. FILTER NO. STACK DIA. Hot Box (*F)			The state of the s
42 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	7-11-17		T. I. I. I. I. I. I. I. I. I. I. I. I. I.
NO SE SE SE SE SE SE SE SE SE SE SE SE SE			Contents
ORIFICE CORRECTION ORIFICE CORRECTION DATE FITOT CORRECTION CONTROL BOX NO. Victorial Stack (a. Hg) (cf.) 3.0		+++	
NG DATA SHEET ORIFICE CORRECTION ORIFICE CORRECTION 226 CALIBRATION DATE PITOT CORRECTION CONTROL BOX NO. CONTROL BOX NO. CONTROL BOX NO. OR. (a. Hg) (*F) (*F)	25.50		2 - 7 - ×
1911NG I	777		
SAMPLIN 4012 - 9.3 4012 - 9.1 6.7 10.7 10.7 10.7 10.7 10.7 10.7 10.7 10	14.7		Negative 2
STACK SAMPLING DATA SHEET E. 7-2(6-93 ORIFICE CORRECT N	eee		Positive — — — — — — — — — — — — — — — — — — —
STAC TEST DATE 7-7 TEST NO. N.	77.6		Medors After CO2 CO2 CO CO CO CO CO CO CO CO CO CO CO CO CO
G. H70)		\\\\\ \\\\\\	
DOLUTE STATOR D. Dry George States and George St	134.8 134.8 203.123		DOM Res (efm) 0.007 0.007
	1320		VACUE CHECK
CLIENT TEST UN PROJEC CONTRO BAROM (actes)	09	11111	SYSTEM Before Angr

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KEYSTONE ENVIRONMENTAL RESOURCES, INC. AIR QUALITY ENGINEERING

Comment Estimales: ¥₩ Probe Temp. E) METER CORRECTION (Y) Telling Turpinger DRY GAS METER NO. 300 Q ELEMBRHOB SOURCE SAMPLING DATA SHEET 190/180 050/130 85c/9H 112/256 91,2/05 Hot Box Temp. E Temp. Stack (F) TEST DATE 7/24/43
TEST NO. N-4- ALD-728
SITE NO. 74/ct 4 Vacuum (in. Hg) 3 d U 2/20/43 STACK DIAMETER Temp. (*F) Meler PORT DIRECTION EX: Rotameter Reading 50. 1.05 1.05 1.05 9 (min) 907 20 0.81 ३ Lest Bernie 825.02 867.29 Dry Gas 854.95 Resding 847.8 807.95 Meler 803. (1 ę G BAROMETRIC PRESSURE SYSTEM OPERATOR. PROJECT NO. NILE Doc E SP 13:42 3:32 13:55 11:15 3:10 Time 5112 Clock TEST UNIT Traverse CLIENT (inches) Point FIS

Pacuum (in. IIg) (Min)
Before (6 02
After (6 02
After (7 02)
After (7 02)
CO2
CO2
CO2
CO2
CO2
CO2
CO2

%H20-

Difference

Initial

Fina

Impinger Contents

mpinger

SYSTEM LEAK CHECK

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Page 1 . 9 (

1-101 5.26			TEST DATE TEST NO.	22-72 N-52-72	28-73 (Wec.	- 00 U	METER CORRECTION METER CORRECTION CALLIE ATION PATE	CORRECTION	NON 0.9735	35	COLD BOX NO.	NO.
اڃاڙ	<u> </u>		STATIC PRES	SURE	61.2 M20	300	PITOT CORRECTION	RECTION	N 6-77	2	FILTER NO.	Y/(
BAROMETRIC PRESSURE	28.9	ود	PORT DIREC	CTION			CONTRO	L BOX NC	CONTROL BOX NO. DEM USBESSE	586535	STACK DIA	A. (32"
Dry Gas		Pitot & P	Orifice	hee A.H	Meter Te	Meter Temperalure	Vacuum	Stack	Probe	Impinger	Hot Box	Comment
Meter Reading		(in, H2O)	Req'd.	Gia. H20)	ة (ğ f	(ja. ffg.)	Temp.	Temp.	Temp.	Temp.	
4565	1		1000	Au 1069	97	97	5,0	299	~28x	48%	-20th	Single Part
	_			} `	97	67	0,5	298				NOATESTIACTA
	_	<u> </u>		1047	97	97	ة أ	299		48		Sompling of
	-			6801	67	16	2,0	299				2 Mone
				6201	98	98	0,5	668		45		the I how
	-			920/	98	88	0.5	299				
				8101	88	98	5.0	299		47		
	_			9601	66	66	0.5	299				
	<u> </u>			288	99	66	0,5	299		48		:
	_			38	E	66	0.5	299				
	_			1030	99	9 9	6.5	300		49		
	-			0)801	99	66	10.5	300				
1550 100,622	77			1033	99	99	5,0	300		49		
						 		[1	Estimates:
7-61072	77					1.6.7	=98°F	(7)	= 17	289 F		MW-29.5
dry Liter	the					7	A)	7.76			RH20= 7
7				-	7		lmpinger	lan.	Impinger			٠.
Rate (2		C02	15.0		-	No.	Con	Contents	Fine	Seitial	Difference 4
13,5			20	20			<u>-</u>	20mc Jarth	HAN	8.96	96.1	40
181	<u></u>	<u>. </u>	00	0			ri	ひまん	THE PARTY	h hb	44.4	0.0
)		N2	0.85			'n.	Enth	•	79.5	79.5	ó
PITOT LEAK CHECK		•	9 70	or Aprile churk	= 20.5°	_8	•	Silversil	30%	102.9	48.7	7.4 Act
			•	120			•				14	RIOM
											KE	KEYSTONE
												Name and American

					3			T															·				F	-				_		ו בי
Page of	0.0	9			Commo																٠	Estimates:	-MM	₹H20-		8	Uniches						7,	KEYSIONE
,	HOT BOX NO.	COLD BOX NO	FILTER NO	STACK DIA	Hot Box	Temp.								_											2								نها	Y !
	35	121	6.17	South 1	Impinger	Temp.	3	63	50	23	45	24	5.¥	47												i .	3							
	9 / NOI	27	1	Paxl		Tomp	2												_			-			1	<u> </u>	cats		•					
HEET	ORRECT	DRRECTIC	PERCTIO	BOX NO	Stack	Tomb		H	_	_																Impieger	Contents							
STACK SAMPLING DATA SHEET	ORIFICE CORRECTION	METER CORRECTION	PITOT CORRECTION	CONTROL BOX NO.	Vector			3.5	4.0	0-4	0-7	4.0	٦, C	7,0												Impinger	У.	1.	2.	3.	÷	5		
LING		228				ð	3	H()	\ \ !\!	105	113	911	5 <u>1</u>	111																				
K SAMP	8 - GB	-4 P-	\ \ \	1	Marer T.	2	(F)	101	70	12/2	32	0H)	7.7	141													Negative			7				
STACI	TE 7-2	125-V	(SIZE,F)	RECTION	O fees to	Ad.	(in. H20)	7.7	0.0		26	ه.	2.6													K CHECK	Positive] -				
	TEST DATE	TEST NO.	NOCCLE (PORT DIR		Reg'd.	(is. H20)	مارد	7.0	2-0	2.6	9	2	2.6												PITOT LEAK		Before	After	:	703	8	8	Z
				1 X 3 X 1		R 4	(F. H20)	\-		-	-	-			<u> </u>	-	-	+	1	-	-	+	+	-	1	1		_			_			
	Partelle DOS		22.8	CONTROL BOX OPERATOR D. 3.4. BABOMETRIC PRESSIRE 2 % 9.1.		Dry Cos Mater Reading	()	カルカ	7623	7,727		2002		707	17.7				}							×	DOM Rate	(F)-)	(1, 00) 3					
			PROJECT NO. 93(02. 8	TRIC PRES				\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	┺-	+-		1	↓		╅ᡓ		2 0	2770					+		 	SYSTEM LEAK CHECK	Vacuen		+	1,1	d l			
	CLIENT		PROJECT	CONTRO	DVAC	Traverse	(jacker)		1	1	1	1	-		-	1	T				<u> </u>	-		1	1	SYSTEM		_	2	1				AQE 2/92

TEST NO. N9-10.1 FEB DATE NO. N9-10.1 FEB	TEST DATE TEST	CE SAMPLING D	VTA SHEET	(1		
STACK DAMETER STACK DAMETE	Content STACK DIAMETER Day Gramm Day Gram Day Gramm Day Grammeter Meter Vacuum Day Grammeter Meter Vacuum Day Grammeter Meter Vacuum Day Grammeter Meter Vacuum Campon Campo	460-730	ORY GAS MEI METER CORRI CALIBRATION	ER NO.		
Contents Contents	Section Reading Reading Exit Vacuum Inter					
	ing Temp. (m. Hg) 35 .90 1.0 2 36 1.0 2 28 .92 1.00 38 .92 1.00 38 .92 1.00 10 .05 2 2 2 2 3				Probe	Comments
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D-7: VOST Train

V-1 1001 - 140 TAS

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SYSTEM	SYSTEM OPERATOR	URE URE	Dennie	STACK DIAMETER PORT DIRECTION	AMETER _							
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25- 4-105-736

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

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TC0 44A Comments 7083 Estimates: NAME **%1120=** 248 ¥¥ Difference To Gall S. S 7 METER CORRECTION (Y) Condense CALIBRATION DATE DRY GAS METER NO. Initial Table Section 1, (IE) 2 22 20 2 CRAINGHIOP & SOURCE SAMPLING DATA SHEET Hot Box Temp. Final <u>.</u> ALR QUALITY ENGINEERING Stack Temp. E. TEST NO. N-4- VOS - 736 C Contents Impinger Vacuum (in. Hg) 3 TEST DATE 7/26/93 Intel SITE NO. TAKE STACK DIAMETER Impinger Meler Exit Temp. PORT DIRECTION E ż Rotemeter Reading 5 Ŋ 4 Y REAding (Fif (Min) 48 47 40 Response SYSTEM OPERATOR Kenny **68**5.59 688.36 705.38 682.79 Meter Reading 705.14 Dry Gas **■** Frita Gen 300 SYSTEM LEAK CHECK (in. 11g) Vacuum 16:00 05:51 15:55 200 Time. 15:53 16:32 PROJECT NO. TEST UNIT Traverse Before (inches) Point

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Run 2

Run

FYRITE MEASUREMENTS

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100 100 1

HOT BOX NO. —— COLD BOX NO. —— PROBE NO. 5-3 FILTER NO. 5-3 STACK DIA. 62.	Comments	- 1057 Tale #1	Senie Cu	-				2099	2008 #TCO13	- 22	\$H20-7		Difference					KEYSTONE
HOT BOX NO. COLD BOX NO. PROBE NO. 5 FILTER NO. STACK DIA.	Hot Box Temp.	7555						#	2									
	Control of	469%						Tarox	lenx >				Fine					
10017	Probe Temp.	2,052~										Impiager	Contents					
ORIFICE CORRECTION METER CORRECTION CALIBRATION DATE PITOT CORRECTION CONTROL BOX NOTE	Stack Temp.	├ 											٥	_				
ORIFICE METER CALIBR PITOT C	Vecoum (fa. Hg)	3,0	2.0	,	7							Impinger	ŝ		1	+	۸.	
Š	Moder Temperature In Out (*F) (*F)				3 - 46							÷			•			
12 (x) (x) (x) (x) (x) (x) (x) (x) (x) (x)	Mater Te	76	76		The same							2						
N-50-V (SIZE, N) PRESSURE -1	Act.											-	15.5	7.5	220			
TEST DATE 7-26-93 (Man. TEST NO. N-62-105-726- NOZZLE (SIZE, M. STATIC PRESSURE -1.0"H, O. PORT DIRECTION D.	Orifice A H Req'd. Ac	500 cepain			+								C02	8 8	3 2	-		
00	Pitot A P	T-1												-	2 3	2 75 E		
MY WENT	Dry Gas Meter Reading	500/1/20	0543.640		A = 2 1095	Dan Files						celmin	Rate (Was)	9.7				
CLIENT BANK L NO TEST UNIT STALL - HE PROJECT NO. 9 32 928 CONTROL BOX OPERATO BAROMETRIC PRESSURE	Time	302	1307	1 1.		3						ECK	in. Hg	0.07	0.0	PITOT LEAK CHECK	NEG.	
CLIENT Sate TEST UNIT STEP PROJECT NO. 9 CONTROL BOX BAROMETRIC P	Traverae	40,24										LEAK CHECK		Before	Affer	PITOT LE	POS	

16, 2001

TEST UNIT CACK - FOR PROJECT NO. 932 029 CONTROL BOX OPERATO BAROMETRIC PRESSURE	PROJECT NO. 932 028-6/ CONTROL BOX OPERATOR TO BAROMETRIC PRESSURE 29	% . 60	TEST NO. NOZZLE (S STATIC PR PORT DIRE	S (SIZE,) PRESSURE	Ves - 7	2-9:	METER CORRECTION 0.9735 CALIBRATION DATE 6-14-73 PITOT CORRECTION	DRRECTION DATE RRECTION NO.	N 0.9735	6535	PROBE NO. S-3 FILTER NO.	K NO
Point Time	Dry Ges Meter Reading	Pitot & P (in. H2O)	Orii Req'd. (in. 1120)	Orifice A H Act. (in: H20)	Mater Te	Meter Temperature In Out (*F) (*F)	Vacuum (fr. 11g)	Stack Temp.	Probe Temp.	Constitution (CVP)	Hot Box Temp.	Comments
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After 10	200		8	0			- 2					
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		PROJECT NO. C CONTROL BOX	N N		TEST NO. AN NOZZLE (SIZ STATIC PRES	NOZZLE (SIZE, M) STATIC PRESSURE - 1. 6" 47.0	5a - 105 - 726 - 3 ZE, 10 SSURE - 1.0" 47.0		METER CORRECTION 0.9 CALIBRATION DATE 6-7 PITOT CORRECTION	PRRECTIC FION DAT RECTION	B 6-14-5	23	PROBE NO. 5	N X NO.	
Mark Reading Mark		KOME1 RIC P	[7]	8	POK! DIKE	C 101 2		17	CONTROL	BOX NO.	מאש מ	586555	STACK DI	A. 75	32,
Water Radiago Temp	Week Reading Read of Control Read of Contr			Pitot & P	Orig	ice A H	Mater Tem	aperolure	Vector	Stack		Caracter		Constitution	Ę
1428 1420 20 cc/min, 94 2.5	146.5 127.7 12.5		Adder Reading	(in. H2O)	Koq'd. (in. 1120)	(in. H20)	= E	§ £	E.	Temp.		Temp.			
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1/58 OF 1/18	1/5	1453					76		2,0						
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	Page /		<u>.</u>			Confi		related /m	postloak C4 cyan		pr lat:		post leed 112%		pe hal						post lul	Estimates	MW-	%H20-	Difference						7	KEYSIONE
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	HEET	ORRECT	TION DA	RRECTION	BOX N	Spek			1			(1	\	\					E	3						
	STACK SAMPLING DATA SHEET	ORIFICE CORRECTION	CALIBRATION DATE	PITOT CORRECTION	CONTROL BOX NO.	Vacuum	(a) He	, "	100		2	*	4		2	3	3	3	w	3					Impieger	ġ 2	- •	•	•			
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	K SAMI	2	1-971	1	Mutas Saruthe	Mater To	<u>ئ</u> و	99	3	3	603	701	20/		105	201	603	(03	103	107	103					Negation.			7			
	STAC	re 2/2	58- VOS	RESSURE	ECTION	Orifice A H	Act.	, ' (ó	0,			0.7	0.1	1.0	.0	0')	0									-			
Run 3 Toyen	Toooza	TEST DATE $2/2L/$	TEST NO.	STATIC P	PORT DIRECTION	ō	Roq'd.	(a. n.o)			0,	0 /			9"/	0.	0	0,7	5	2	-				PITOT LEA		Pefore	ABer	18	2 2	8	£
· C) F	7		B	0000		Pitot & P		E # (2)			1	1	1		1	1	1	1	1	1								 -	,			
Run 2 TOYBA	TC0564	CLIENT BATIETE / NILES	166#2	PROJECT NO. 93/0/6			Mater Reading	3000	2000	79.75	1056.08	9. B. S.	87.0.58	200	101000		17.21	70.10	77.50	24.5	1 077 02	70.110			ž	DOM Res	(clm)					
Ran!	V 450	BATE	NIT BOL		BAROMETRIC PRESSURE	Time		_	2/106/	1.86.3	1266	2	, 0		2000	2 2 2	, ,	12	10	3/2	3 6	20			SYSTEM LEAK CHECK	Vacuum	(in Hg)					نج
X F	# 70	CLIENT	TEST U	PROJECT NO.	BAROM	Traverse	F	3	1	1	1	1	j		1	1		1	1		1				SYSTEM			Before	Aher			AQE 2/91
Tonas	1/0																															

N-4-VOS-728A, B,C

KEYSTONE ENVIRONMENTAL RESOURCES, INC. ALR OUALITY ENGINEERING

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APEOST OF TC035A TC014A Abres Estimates: Saple 107 4089 70 88 %1120= ¥Z Difference Temp. Probe (F) DRY GAS METER NO. $E. M. - q - VOS^{-200}$ METER CORRECTION (Y) CALIBRATION DATE Temp. Initial (F) 20 Ø 9 **PRANTHOP OF SOURCE SAMPLING DATA SHEET** Temp. Ted Te Final E S 5 7 7 Temp. Stack £ Impinger Contents Vacuum (in. Hg) 77 7 8 3 Y M 0 1/28/ TEST DATE (L-STACK DIAMETER mpinger PORT DIRECTION Meter Temp. E ŝ Rotameter Reading .55 **4** ろ .4S 45 ¥ = 7 (Muin) THE STATE OF THE S SS 53 ş M MIN PUN 47 10 5 5 525 65 78 : 1:50 Punic R. F. Clow 177.87 789.65 Meter Reading 774.40 775.22 797.23 Dry Gas 781.38 780.50 181.58 THE STATE OF THE S 772.10 775.46 ("tec/min) (ge) RE 2 0.00 FYRITE MEASUREMENTS **BAROMETRIC PRESSURE** PROJECT NO. Wiles Ó SYSTEM OPERATOR LEAK CHECK DOF (in. Hg) 05:01 Vacuum 54:01 10:25 Clock 04:01 50:11 Time 13:01 FILE 25:11 Fud Æ 1:41 1) - 30A - 1-1 End SYSTEM Traverse Before SYO (inches) Point 1-VO5 After 200 Z ဥ 70 ST A BE

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Page 13/

TEST UNIT SEL	16 16 1 5,00	2	TEST DATE 7-28-93 (W.d.) TEST NO. 17-50 - VOS- 720 - NOZZLE (SIZE.)	7-28- N-5a-	25-20		ORIFICE CORRECTION —— METER CORRECTION OR 7x5 CALIBRATION DATE ————————————————————————————————————	ORRECTION DATE	ION 0.973		COLD BOX NO.	NO.	
~~ !∰	1700	5 96	STATIC PRI PORT DIRE	ECTION D	1.0"11.0		PITOT CORRECTION CONTROL BOX NO. XAMES 635	RRECTIO BOX NO	N Services	635	FILTER NO. STACK DIA.		
Time	Dry Gas Meter Reading	Pitot A P	Req'd.	Orifice A H Act.	Mater Te	Meter Temperature In Out	Vecuum (in. iie)	Stack Temp.	Probe Temp.	Control of Control	Hot Box Temp.	Commenta	
5/60	007.8100	1 1	N.	**	88		2.5		7051~	×89×	7.092~	WOST TICK	1
0760	895,0500				88		3.0			36.6		Some no	12
												0.5 c/ma	
A25	1-2.368			9	Taub.	88	少						
132	An Litera				1	9							
										Tenal	5R1#	Z	Ī
										Times	-Change #	#7CØSZ	A
													Ī
												MW-29,4.	6
													46
	cehai	<u>د</u> ا			7		Impinger	Impisger	<u> </u>				,
in. Hg			200	15.0			χο.	Contents	ents	Final	Ladia	Difference	
000	200		8 8	,))			- 2						
k	1		N2	78.0			3						
PITOT LEAK CHECK	<u> </u>						4.						
	1										K R	K EYSTONE	
	7												

1 mg/mg/

HOT BOX NO	COLD BOX NO.	E NO. 5-3	FILTER NO. STACK DIA. 132"	Box Comments		SF NOST 70/2 #2	10mm nn	at 05 chur						1900	Share # Todody	Estimates:	MW- 29.5	8H20-9		id Difference					7
TOH 1				tuginger Hot Box	(*C/*F) (*F)	1885 -2835	40							4,00	They do					Find faitid					\ ₁
RECTION	METER CORRECTION 0.9735	6-14-	CONTROL BOX NODEN USB655	Probe	Temp. Temp. (*F)	7													lmpinger	Contents					
ORIFICE CORRECTION	METER CORR	CALIBRATION DATE	CONTROL BOX NO	Vecuum	(j. 118)	3.0	20		6 :0		The second								Impinger	No.	~	7	ei ei	.	
(4,10,6)	50-105-728-2		1.0"/4.0 D	er Tempe	- OFF	88	89		90 06		1.41 = 89	may Me							2						
		NOZZLE (SIZE,A)	PORT DIRECTION	Orifice .	-d. Act. 20)	7														0.5/ 1			1 78.0		
TEST				Pitot & P	(in. H2O) (in. 1120)	5000				_										C02	70	ප	22		
16 /26	1- Hot 5.de	930028-0	RESSURE 28,96	Dry Gas	Moter Reading	1604/152			039,011		A =4,899	des wited	P						celouin	Rate (7.0	9.0		ğ, r	<u> </u>
CLIENT RAM	TEST UNIT SE	PROJECT NO.	BAROMETRIC PRESSURE	Traverse Time	Point	0416	1560		03560		01=0	min		-					LEAK CHECK	in. Hg	Before /O	After 10		PITOT LEAK CHECK	+

18ge 1 % 1

CLIENT 200	72 12	de	TEST DATE	728-97	7-28-93 (Wed.	20-3	ORIFICE CORRECTION METER CORRECTION	ORRECTI	ORIFICE CORRECTION METER CORRECTION 0.9735		HOT BOX NO.	1 - 1	
PROJECT NO. CONTROL BOY BAROMETRIC	PROJECT NO. 43C.628 -40 CONTROL BOX OPERATOR 1 BAROMETRIC PRESSURE 28	75	NOZZLE (SIZI STATIC PRES PORT DIRECT	ZE, M SSURE -	1.0" 12.0		CALIBRA PITOT CO CONTROI	RECTION DATE	CALIBRATION DATE, 1449 PITOT CORRECTION CONTROL BOX NO DAM 458455	3655	PROBE NO. FILTER NO. STACK DIA.	1. 5-3 N. 132"	
Traverse Time	}-	Pitot & P	Orifice	1 - 1	Moter Te	Meter Temperature	Vacuum	Stack		13.2 m		Commenta	
Point	Mater Reading	(in. H2O)	Req'd. (is. 1120)	Act. (in. 1120)	- (.	¥ £	(is. 11g)	Temp.	Tensp. (*F)	(*C)	Temp (F)		
401	1			hu	16		3.0		7.85m	1897	7.85~	165T Tabe #3	_
	_												
7111					16		3,0			42		Bruin Con	
												at 0.5 chain	
t111					1/		3,0			38		,	
1122					16		3,0			38			
										K			
4211					16		3,0			39			
<u> </u>													
132					2/2		5.0			27			-
5	T				ó		C			7	XII	62	
151	3				1					Jan 1	Chain	1 # TC 0 53	
+										7		Estimates	
4= 30	1 12.14.845				(Trucke.)	16= 4	K					MW-29.5	-3
1 1	1											8H20-9	
LEAK CHECK	1			•	1		Impinger	Impinger	u t er				
is. Hg	-		202	15.0		,	ν.	Contents		Fine	lakin	Difference	
Before 10	5,0		03	2.0	i								
Ase: 10	_		8	0			2.						
			N2	18.0			=						
ZE	HECK						* *						
POS. NEG.						_	•						
											KE	KEYSTONE	
]		

The part of the	CLIEN	+		•	#	STACK SA	<i>TACK SAMPLING DATA SHEET</i>	PLING	DATA S	HEET				Page / of /	
Fig. 6 F	TEST	UNIT 25	RATTELLE	Nice	TEST DAT	N= 2/25	1/93	28-123		CORRECTION	7	663	HOT BOX	NO. X NO.	1 1
Time Pressure 29.9 Post Direction A Contract Box No. Abbed, Fig. \$25,245, AKR DIA.	CONT	ROL BOX (OPERATOR A	0	STATIC P	SIZE, I) RESSURE			CALIBRA PITOT CO	RRECTIO	4/23	- 1	PROBE N	0.	
Time	BARO	METRIC PI	RESSURE 28.		PORT DIR	ECTION	A			BOX NC	Notech	2	STACK D	.Y.	
175 CSTE, CS 1	Traver		Dry Gas	Pitot A P	É	¥ 1 20	Meter T.	emperature		Stock	Probe	Judet	Hot Box	Comments	_
1/5 (28/2.42	Point (inches		Meder Reading (dcf)	(ie. H20)	Fed 6.		= €	8 E	Cir. Rg)	Ē	Temp G. E.	(C/F)	Test (F)	LEAK CHEC	- <u>%</u>
1720 12820-112	73 17 18		6878.83	_		1.0	32	86	W	1	{	led		02	0
1/6 2850 4/2			1880.13	(\	1.0	76	101	2		}	-			3
1/05 1/2													-	ſ	-
1005 83, 2	7		24.0389	1	l	07	47	47	3	1	1	(e.)	1	28	50
1005 95.6			83,2		(1.0	86	700	N	١					T-
		1005	95.6	1	١	٠ -	46	£0}	2	(1	_)	7.3	10
1/05 1/2			.3	Senumbe	pota	3:20	to 5	eased	40						
1/105 2584, 54		_													-
1/1.6 269,17	3	 	1.886.5V)	1	tot	101	101	3	1	1	160	1	3 (1/2	~~~~
1/15 281,7		9///	7).698	1	١).	00/	60	w	1					1
1/2		5111	291.7	İ	{	0.1	101	501	2		}				_
1/3 \$400.6		1120	842.9	1	1	0.)	101	101	W		1				_
1/36 \$400-1-		1125	848,4	Į	1	7.0	101	106	8	1	١	_			T
1/35 1/20.1 1.0 1/21 1/22 3		1136	+:40	1	-	1.0	101	201	3	١	{			poste	
LEAK CHECK		135	100.1	1	1	6.0	101	20)	i,	1	1			Estimates:	 -
LEAK CHECK												-		MW-	
LEAK CHECK														#H20-	
LEAK CHECK Impires I															
Vaccineta DOM Rate Positive Negative No. Contents Final Initial	SYSTEN	I LEAK CH	SS.		PITOT LEAL	CHECK			Impiager	inger!	<u> </u>	i	•	;	
(in. Ng) (cfile) After CO2 CO2 CO3 M3 After S. 4.		A Person				E P	2000	_	2	3		1		Difference	
AAA-		-	(c(m)		Pefore	1			-						
CO2 CO2 S	Defore				Affer	-].		7		•				
SO CO CO CO CO CO CO CO CO CO CO CO CO CO					1 505	<u> </u>	-		1						
CO 2				·	38				* "						
N2 The second se				<u>+,—,+</u>	8								4	4	
	96.901	•		ب	Z			٠					×	EYSTONE	

Page of	Connonts Service Names	7080	7/04	750278		7095	12052A			Estimates:	MW-	#H20-	
	Probe Temp.												Difference
T ETER NO RECTION (Y	Temp.	5/	14	14	13	12	11	77	12	[3			Initial
OUALITY ENGINEERING SOURCE SAMPLING DATA SHEET 1/70/93 DRY GAS METER NO. 1/70/93 CALIBRATION DATE IGHT CALIBRATION DATE	Tenta to the second	20	7	4	2	77	4	5	5	2			· Final
E ENVIRONMENTAL RESOUR AIR QUALITY ENGINEERING BEAL SOURCE SAMPLING DA TO 1 70 93 TO 1 4 - 105 - 730 480 DIAMETER	Stack Temp. (*F)												Contents
ONMENTA LLITY ENG JURCE SAN 70 93 9 - 105	Vacuum (in. Hg)	3.5	25	7.0	2.0	2.0	2.0	2.0	2.0	3.0			
ENVIRO R QUAL SOUN E 7/2 AMETER	Meter Exit Temp.												No.
EYSTONI TEST DA TEST NC SITE NO STACK I	Rolsmeter Reading	9:		9	٠.	5.	.45	36	.49	74.			
KI	Roller Beating	.50		.70	72.	19	/5'	. 42	. کو	65.			Shin 146
[7]	Dry Gas Meter Reading Lef (dof)	869.85	7 × 200	976.44	879.17	C. 878.95	882.58	12.488	887.16	895.850	897.04		Marie e
CLIENT ESP TEST UNIT ESP PROJECT NO. ALL SYSTEM OPERATOR E BAROMETRIC PRESSURE	Clock Time	017:6	. 8	10:05	10:10	Q5 ; 0)	0:35	10:40	05:0	11:02	End		SYSTEM LEAK CHECK Vacuum Before (in. 11g) (when no no no no no no no no no no no no no
CLIENT TEST UNIT PROJECT NO SYSTEM OPE BAROMETRI	Traverse Point (inches)												SYSTEN Before After GO2 CO2 CO2 CO CO N2 AQE 1992

STACK SAMPLING DATA SHEET

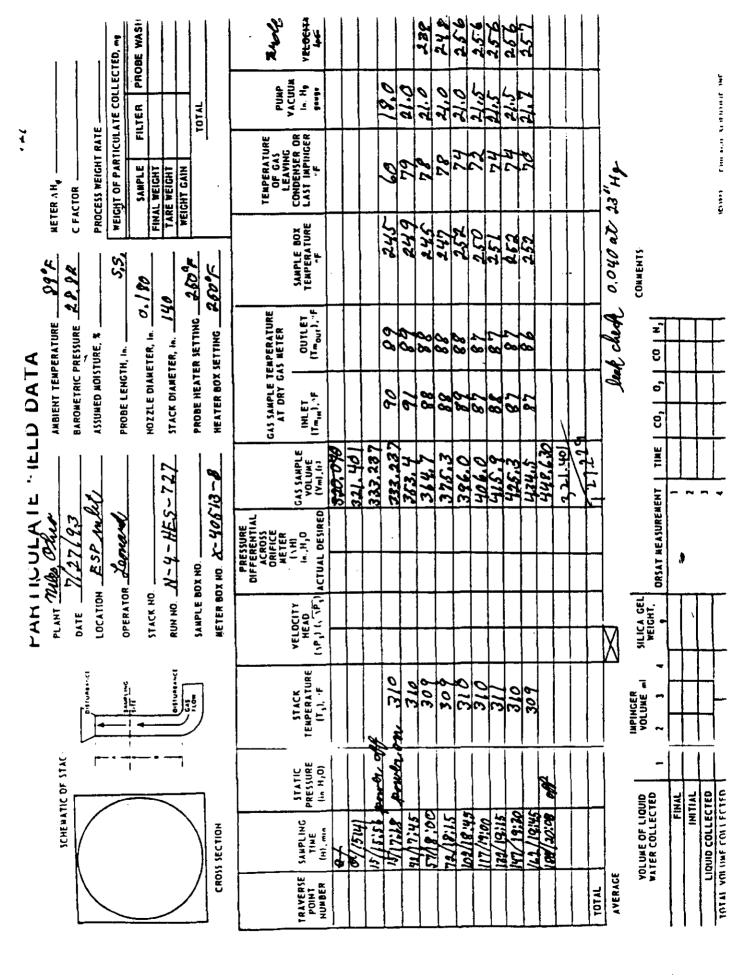
	0. NO. 5-3	Comments	YOU LAVE #1	O,5 chair	,			ו ו	父#元の孔 Estimates:	MW=29.5	%H20= 9	Difference				KEYSTONE	
?	HOT BOX NO. COLD BOX NO. PROBE NO. 5- FILTER NO. STACK DIA. /3		7052					Tana # 10	* Obres			Initial				KEY	
	3 86535	Conference (*CV*F)	£87>	362				1900	hees			Finel					
	ORIFICE CORRECTION —— METER CORRECTION 0.9735 CALIBRATION DATE 6-4-53 PITOT CORRECTION —— CONTROL BOX NO. 25-4-555	Probe Temp. (*F)	€250%									Impinger Contents					
MEEL	ORIFICE CORRECTION METER CORRECTION CALIBRATION DATE PITOT CORRECTION CONTROL BOX NO. 24	Stack Temp. (*F)										£ŏ					
AIA	ORIFICE METER CALIBRA PITOT C	Vacuum (in. Hg)	3.0	3.0								Impinger No.	انا	3	* 0		
		Moter Temperature In Out (*F) (*F)			= 78%	3											
SIACK SAMPLING DATA SHEET	E 7-30-93 (Fr) N-5a - Vos-730 SIZE, M ESSURE - L2' 120 ECTION	Mater Te In (*F)	9,5	36	(100)							2					
STAC	ZE.D.	Orifice A H Act.) (in. H20)	- A									- 1	6.0	200			
	TEST DATE 7.30- TEST NO. A-52 NOZZLE (SIZE,#) STATIC PRESSURE PORT DIRECTION	Req'd. (ia. H20)	500 ce/2									600	02	00 Z			
	2000	Pitot & P (in. H2O))					
•	CLIENT RAPIC XXE TEST UNIT SPACE - HY PROJECT NO. 92 628 - 6 CONTROL BOX OPERATOR TR BAROMETRIC PRESSURE 28.8	Dry Ges Meter Reading Dry (#02/r/e/)	A26.3.386	266,002	1=26K	dry Likely	0					Celmin	3.0	6.0	×		
•	FINO. OF TRIC PR	Time	926	931	1=5	3.5						CHECK	a		CHECK	1	1
	CLIENT RATE PROJECT NO. CONTROL BO BAROMETRIC	Treverse										LEAK CH	Before	i	20103		
						•	. 4						٠,٩	HVI.			

#75033 10 min con ex mer MW-29.5 KEYSTONE USE Comments Estimates: Difference **≴**H20− STACK DIA. 132" اردواد ۱ ک ह COLD BOX NO. PROBE NO. 5. HOT BOX NO. 99 FILTER NO. That otherway Hot Box ~29% Temp. inite. £ Company 488× Tanas. C C Fig CONTROL BOX NO DEM 4 5BC 533 38 METER CORRECTION 0,9735 CALIBRATION DATE 6,4493 2882~ Probe Temp. E ORIFICE CORRECTION Impiager Contents PITOT CORRECTION STACK SAMPLING DATA SHEET Temp. Stack E Vecuum (in. Hg.) 5,0 9,0 3.0 Ť ż × Meter Temperature E ð ţ) -12"40 TEST NO. N-5a - 405 - 750 -TEST DATE 7-30-95 (Fi 4 <u>د</u> ق 44 PORT DIRECTION D 0,0 79.5 (h. H20) STATIC PRESSURE Act. NOZZLE (SIZE,A) Orifice A H (In. H20) Sweet Req'd. 8 2 8 2 Pitot A P (in. H2O) Dry (more the CO2.352 Meter Reading 1805=1 dustitle 1207.439 TEST UNIT STECK - MAPPROJECT NO. 93C 628.
CONTROL BOX OPERATOR Dry Oss 2.0 200 BAROMETRIC PRESSURE PITOT LEAK CHECK 0/0/ 800 Ë .s NEG. Orap 300 8 9 LEAK CHECK Traverse Before SS. After Point

) J o						monte		1.8 书		CM CO	1 16									A1516	- 22	3.5	0		8		-		<u> </u>	}	KEYSTONE
Page		₹. 1	. 5-3		1:132	Comme		1/2/2		30 mg	250					-		ı	2	(* T)	Estimates	MW- 29.5	%H20-		Difference					7	EYST
	HOT BOX NO.	COLD BOX NO	PROBE NO.	FILTER NO	STACK DIA. 132	Hot Box		7882											7 108	Clarca					Laitin					4	X
		3	٤,		2,555	Jenninge	100 T	30877	45%	20/17	42°F	4806	454						Mark :	kny		-			Fine						
	TION	10No 9 23	TELMA	NO (CONTROL BOX NO. 25-1(158,555	Probe	į	1200×							,									Inciple	Contracts						
HEET	CORREC	ORRECT	A NOLL	RECT	XON	Sack	Ę				}													,	3						
DATA S	ORIFICE CORRECTION	METER CORRECTION 0.9	CALIBRATION DATE 67	PITOT CORRECTION	CONTROL	Vacuem	£ 5	30	3,0	3,0	3,0	o, w	3,0	3.0		2								Impiater	ž		7.	e,	4 %		
LING	~	5-3		3		porefuse	3 5									7685 =	l '									_		·		•	•
STACK SAMPLING DATA SHEET	7-30-93 (Fri,	- YOY - 750		041/21	۵	Meter Temporats	<u> </u>	2/2	1/2	42	36	12	1/2	76		 (T.L.)	5		 						Negative			7			
STAC	E 7-30-	4	(SIZE,D)	UESSURE	ECTION CECTION	Ha eail	Act.	١٠٠																K CHECK	Positive			-1	5.5	200	777
	TEST DATE	TEST NO.	NOZZLE (DE DIE	ĺÕ	Reg'd.	1/1	-	-														PITOT LEAK		Pefore	After		6 6	8	W2
				× 6	20	Pitot A P	(Je. H20)																		·	.1	- 	j L		-11	نـ
	,	١.٦	10 28 - W	CONTROL BOX OPERATOR	ESSURE 28	├	**	438	٦ .					42737		1 = 14.63	tu cited	1							DOM Rete	Cel in man	40	20			
	Butelle	IT Space	PROJECT NO. 932	L BOX 0	BAROMETRIC PRESSURE	Time		10/1/2		188	%/	18/	0///			A=30 4				!				LEAK CHECK	Vacuum		+-	0			
	CLIENT	TEST UNIT	PROJECT	CONTRO	BAROME	Traverse	T (T^{T}																SYSTEM L			Before	Aher			A06 3/62

	1	,					<u> </u>	11	-4				M The	·	ني _و طـــ	١					7,5	40	_										
, , , , , , , , , , , , , , , , , , ,	D V VO	SOAMO.		¥.		Corntraceta	LEAKY	thin (point	20.78.05		11.3		o.t. 8 7 . 63	1	Dr. 4 / 1. 63						Oct. 4 1. 03		Estimates:	MW-	%H20-		Difference						AQE 6.92
	HOT/COLD BOX NO	PROBE NO.	FILTER NO.	STACK DI	וטאו אולב	Hot Box					/				1	-								-=-			leitie.	 -		+	1	1	*
TERNAC		0.9993	193	CONTROL BOX NO 1/2/2/2 4/2 CONTROL BOX NO 1/2/2/2/4/2	2000	Impinger		16.6	1 = 1		jus	1 - (==		10.0	-						-					Final			1			
KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET	TION (A HE	3	TE 4/29/93	NO NO	Notech	100	E	-	1		1		ı]											ı	ente.			1			
OUALT REET	CORREC	CORRECT	CALIBRATION DATE	CONTROL POX NO	1		(3)	1	1		1	1	1		1	_										Impia ger	Contracts						
ES / AIR	ORIFICE	METER	CALIBRA	CONTROL			(ir. Hc)	200	8,6		3.5	3.5	3.5		2,5							1					Š		7		*		
ESOURC (PLING)		2-1.2.3				3	E	88	98		85	88	18		48	88	28	88	89	83	89								—.A.,			,	
IMENTAL RESOURCES / AIR QU/ STACK SAMPLING DATA SHEET	26/0	58-105-720-1.2				m i	(E)	85	83		85	84	h8		th8	153	84	48	#8	484	P8						Negative			-			
o 184 TIRONIM ST	1	N-5B-	NOZZLE (SIZE,)	ECTION	7		(ie. H20)	0.7	1.0		1.0	6.0	1.0		6.0	1.0										K CHBCK			-	•			7
NA BIN	TEST DATE	TEST NO. A	NOZZLE	PORT DI	340	Legains	(in H20)		}		•		-													PITOT LEAK CHECK		20	\$ 000 m	3 8	20	8	£
TOTA TOO?		gS 20		28.43	3		(is. H2O)		(ļ					1									1		- [_1	J	<u>L.</u>		-	٦.
7102 70584		1 1	43038		112	Mater Reading	(4 c)	6402,35	1805.96		6806.72	6608.33	19.0163		910.79		6915.93		6920.37		6724.93					5	DOM Rate	(C(3))					
TENAX TENAX/CHARCOMA	CLIENT BATIELLE	NIT POLC	REW A	BAROMETRIC PRESSURE	, je			823	29.34		0458	1003	1000		1045	1050	1655	/100	(105	0///	1.15					LEAK CHECK	Neces II	ē 3		-			
TENAX TENAY/CI	CLIEN	TEST L	TEST CREW	BARON	Traverse	Point	(EC)	Run			Am 2	•			RUN 3						• }					NI SIEM			A Paris				

D-8: HEST Samples



					STAC	STACK SAMPLING	LING	DATA SHEET	HEET				Page / of 2
CLIENT	· batten	A DOG		TEST DAT	ATE 07-27	f	(156)	ORIFICE CORRECTION	CORRECT		252	HOT BOX NO.	No. 32
TEST U	TEST UNIT STACK - HE	닏	بر	TEST NO.	4		27	METER CORRECTION O	ORRECTI		7/2	COLD BOX NO	2
PROJEC	T NO. 9	PROJECT NO. 93CO28-01		NOZZLE (SIZE,	Galio		CALIBRATION DATE	I KON DA	11 05-77	-73	PROBE NO.	17
CONTR	CONTROL BOX OPERATO	* p	200	STATIC PI	PRESSURE	-1.0.14.0	0 0	CONTROL BOX NO.	BOX NO			STACK DIA	0. KT # E.
DVVG	Till I	╢,		6	N o sel	Meter Te	Sapa a	Vacuum	Stack	Ш	laspinger	Hot Box	Conments
1		Mater Reading	1	Req'd.		⊒ €	9 5	(j. He)	įį	Tomp.	1 () () () ()	<u> </u>	
0,7	12.45	17		0.0	0.00	20/	26	37.0	296	~250%	389>	7,092~	May Direct
1		1		200	80	60	36	21.0	296				۳۵۰۰ زیوریا
	-			8.	0.40	90	63	21.0	236				SAMPLING POR
				0.90	0.4°	108	3/2	31.0	300				Hears
				060	90	0//	36	310	202				PP. 1- 1.4
				000	0.0	911	36	31.0	222				
	24.67			060	0.2	113	601	200	30%				RENDINGS
				0.60	06 8	11.3	(09	210	396				Educe 10 min
				300		2//	1.01	21.0	395				,
				0.95	36.0	€//	401	305	650	-		•	
				2.0	26.0	2/	301	30.5	200			Filler 3	43-6243
	·			5.00	29.5	10	70	30.5	300			7	4 93-1126
	14.45			1.00	001	1160	c)QI	25.00	300			7	#13-M265
				1.00	007	011	100	205	300				
	,			007	007	011	J.S/	205	200				Estimates:
				Ç	8.	011	701	20.5	53E				MW- 29.16
				1.00	1.00	011	100	305	27				SH20- 7-0
	,			1.05	1.05	1160	106	20.5	350				_
SYSTEM	SYSTEM LEAK CHECK	ECK		PITOT LEAK		7851		Impinger	Ē	Impiager	i	:	:
	Vacuen	DOM Rate			Positive	Neppi		8	3	3 1			272 1 2721
	G. HC			Before	y 0	40			740	0770	686.5	241.4	132 45
Perore	0.0	4,00%		Alber	¥9-	4		4	3/3	200	7.65	435.7	Τ.
AMA	71.0	20,02	_	203	150			•	10/10	50%	0.469	654.3	39.7 A.A.S
				70	00			S					Horske
				8	0							الما	7
AQE 2/97	<u>.</u> .			Ž.	440							¥:	KEYSTONE
,												ز	

Page 2 of 2	HOT BOX NO. A	PROBE NO. 5-2/	FILTER NO. 1537 # 15 STACK DIA 1754	.][Town	(°F)	wast sink Rut	Mottolinetic	Sampling for	4/ho/s		hapt	44-1.40		Apolises over	10 ince 0		e# 93+ 02.736	#92M-11264	772W- 00 #	Estimates:	MW=27.6	8H20-9		latin Dulcretos]	KEYSTONE	100 11 10 100 10 10 10 10 10 10 10 10 10
	"	200		1		(*C/*F)	18%									299 K		1-14		·				i	35							
Ŧ	1	ATE 5.7	FION C. B.	Ш		(4.E)	78522									H	2							Impiager	Contents		•					
STACK SAMPLING DATA SHEET	ORIFICE CORRECTION	METER CORRECTION CALIBRATION DATE	PITOT CORRECTION	TOT TOWN	Vacaum Stack	(a. Hg) ('F)	205 300	25 30	0		105 0:06	20.0	-		/	1/2	5							,	No.	-	2.	1				
LING DA	3	727 ME	2.0	3	٤,	E	106	OE 001	\vdash	-	_	101 201				4801 =	2								_[_		
K SAMP	727-93 (Ne	1 2 1 1 C	1.00	779	Motor To	• E	2311	1/2	//6	3/	3//	7)//				777									Negative			2	1			
STAC		10. N-5a.			3	(e. H20)	╄		1.05		01.1	1.10				ab.0= 3.								PITOT LEAK CHECK	Positive			-	7	3	40	
	TEST DATE	TEST NO		2	Pio 1 P	(le. H20) (is. H20)	┼	٧ ر ٧	201	0,,	0/./	0/"			,	(AH)								PITOT		Before	After		203	5 8	8 2	
	NOT.	あった。	2 2	۲		Mater Reading (fe.	<u> </u>						200			=139.92	404								DOM Rate	(cin)						
	CLIENT Bette/le/	III Stak	CONTROL BOX OPERATOR	3	Time	1	×5. ×	-					820 24.11	1		1 = 245 A =	<u>1</u>	33.0						LEAK CHECK	Vacuum		_					
	CLIENT	TEST UN	CONTRO	BAROME	Traverse	ĮĮ													:					SYSTEM			Before	Aler] 			AQE 2/92

					: & 10	Misse 93-M262 Brn 93-M262	Missie 93 - M263 Brn 93 - M262	HES	HGST FILTER #3	ю # #2	i Kale Runn Bonn	FOR (Quality) MUSSIE (Carles) POTTON (Carles)	-43-42136)- 13-14264)- 93-ME65
					STAC	K SAMI	STACK SAMPLING DATA SHEET	S ATAC	HEET	,	,		Page of 2
CLIENT	BATTELLE	777		TEST DATE	TE 7/27	66/4	,	ORIFICE CORRECTION	ORRECT	- 1	み、あっ	HOT BOX NO.	NO.
TEST UN	TSB	TEST UNIT 5 B		TEST NO.	N-158	3-4-	£25	METER CORRECTION	ORRECTI	2.0 NO	7	COLD BOX NO.	C NO.
PROJECT	NO.		90,	NOZZLE (SI	(SIZE,#)			PHOT CORRECTION	PERCENT.	2 N	715	FILTER NO.	<u> </u>
CONINC	TPIC PP	- 12	74×6	PORT DI	PORT DIRECTION			CONTROL BOX NO.	BOX NO	. 8. S.	#.0	STACK DIA	Y
		Dar Gas	Pilot A P	Ō	Oriton A H	Meter To	andersture	Vacaum	Stack			Hot Box	Consmoods
Point		Moter Reading	<u> </u>	Rag'd.		a 6	3 6	(in. Hz)	i G	Temp.		Temp (*F)	
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	140	h'7h&			2.1	138	122	9	-	-	_	+	Estimates:
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SYSTIEM	LEAK CHECK	ECK		PITOT LEAK	AK CHECK] 	Impinger	Impiner				!
	Vacuum	DOM Rate			Positive	Negative		Š	Contonts		Fise	P. P. P. P. P. P. P. P. P. P. P. P. P. P	Difference
	(in. Ng)	(cfm)		Before									
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AS	4	0.001			-[7		ri i					T
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AQE 1/92												=======================================	

CLIENT Pathell PROJECT NO. 930018 PROJECT NO. 930018 EAROMETRIC PRESSURE 28 Trivere Time Dry Ges Point (det) Cotton Of 100018 The 15 80 1.00 The 15 80 1	(iii. N20)	DATE OF THE CO.	STACK STACK SIZE 7-23 SIZE NO. 1	SAME STATES OF THE SAME STATES O	12.7 12.3 12.3 12.3 12.3 12.3 12.3 12.3 12.3	STACK SAMPLING DATA SHEET 2 7-23 973 ORIFICE CORRECTION 1ZE. 9 CALIBRATION DATE CALIBRATION DATE CALIBRATION DATE CALIBRATION DATE CALIBRATION DATE CALIBRATION CALIBRATIC CALIBRATIC CALIBRATION CALIBRATION CALIBRATION CALIBRATIC CALIBRATION CALIBRATIC CALIBRATION CALIBRATI	SHEET CORRECT TORRECT TORN DA Suck Torn (*F)	TE 6-9 Te 10-7 Te 10-7 Temp.	2 × 1 3 - 7	Page COLD BOX NO. COLD BOX NO. FILTER NO. FI	NO. NO. Orange Zof Z. No. Orange Zof Z. No. Orange Zof Z. No. Orange Zof Z. No. Orange Zof Zof Zof Zof Zof Zof Zof Zof Zof Zof
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TED, mp	VELOCITY Ips															
66 TOTAL	'	017	2.0	21.0	2/05	21.5	21,6	21.5	24.0	22.0				subor Start at 23"He		ON JOHN BUILD WE
C FACTOR PROCESS WEIGHT RATE SAMPLE FILTER PROBE FINAL WEIGHT TARE WEIGHT WEIGHT GAIN TOTAL	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER	29	73	72	74	6.7	62	779	99	79			,	Buch .	2	(C)1978 - C 100 417.0 C
7 28.75 CF PRO 5.28.75 CF TA TA TA TA TA TA TA TA TA TA TA TA TA	SAMPLE BOX TEAPERATURE	645	248	252	252	263	253	257	256	264			0.08 chu at. 24"Hp	COMMENTS LITE	\$	•
	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (Tmin)."F (Tmout!."F	84	79	000	78	700	8/	28	820	18			ear	8		
AMBIENT TEMPERATUR BAROMETRIC PRESSUR ASSUMED MOISTURE, A PROBE LENGTH, In. NOZZLE DIAMETER, In. STACK DIAMETER, In. PROBE HEATER SETTING HEATER BOX SETTING	GAS SAMPLE AT DRY INLET (Tm,u),*F	64	80	000	9.2		78	18	78	18			saled of	(0, 0)	+	-
729 FR	GAS SAMPLE VOLUME (Vm},ii)	8h 25h	474,	E 788	504.1	5140	532.5	27/15	550.7		- 3		1 51 Dec	-	- ~ .	<u> </u>
PLANT THEACHE ONLY PLANT THEACHE ONLY DATE 7/29/93 LOCATION ESP ANDLE OPERATOR JEDNAN STACK NO. STACK NO. METER BOX NO. X-405/12	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER ('N.H) In.'H,0	1 387	1.50	1.40	1,30	07/	1.10	2007		28.0				ORSAT MEASUREMENT	•	
PLANT 22 PLANT 22 LOCATION OPERATOR STACK NO. SAMPLE BO WETER BO)	VELOCITY HEAD (AP.) ((\TP.)												\mathbb{X}	SILICA GEL WEIGHT.		
12) BULL 18:0	STACK TEMPERATURE (T,), 'F	299	360	300	308	302	300	30/	30%	300				IMPINGER VOLUME mi 2 3 4		——————————————————————————————————————
CHEMATIC OF STAC	THE PERSON NAMED IN COLUMN NAM	243	4			26.0	+		269		A86			TED 1	FINAL	
CROSS SECTION	SAMPLING TIME (B), min.	01:21/31	30/13:40	45/13:55	75/14:45	05:51/06	01:51/02	32:5/12	1,5/16:55	01:91/08/	(S:91) oca			VOLUME OF LIQUID WATER COLLECTED	FINAL	uži:
Š	TRAVERSE POINT NUMBER	42 m										TOTAL	AVERAGE	Ä		

~			# 154		Γ		T †	7	70774	Ę	40	0									7				134 C		力を	0	<u>- د</u>	wishle.	13.2%	(+1
Page / of 2	*	K NO. *	S. 81945	7	Comments		Sixts Paint		4 1/K	VONIX CONDIX	TREAST D	्रत				1302735	98-H285	13-11286		٠	Estimates:	MW- 29.1	SH20- 9.0			Difference 6	14.41	11.6	424 M	100	7	KEYSTONE
	HOT BOX NO.	COLD BOX NO.	FILTER NO	STACK DIA	Hot Box	٦ چ د	 	-								石をも	5#	#								Teitie Teitie	544.0	1.67	2,020		٦	X
	المحصر	2612	40	20	Impinger	1 to 1	B													-		-				Fire	716.8	418.0	6.000	7.00		
	7		NO CLES). S6V61	100																				1		ない	07.60	6.0			
SHEET	ORIFICE CORRECTION	METER CORRECTION OF	PITOT CORRECTION	CONTROL BOX NO	Sect	į	233	600	75%	234	1204	796	1234	1254	225	295	1294	295	291	395	20%	206	295	295	Impiege	3	100	300		1 20.00		
STACK SAMPLING DATA SHEET	ORIFICE	CALIBRA	PITOT C	CONTRO	Vacuum	9	0.91	0.4/	18:0	0.31	18.0	18.0	18.0	08/	03/	60	18.0	W.0	100	18.0	16.0	150	150	0,8	Impinger	Š	,	7	4	35		
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K SAN	02-,29-93 (Thus	100	1 !	loci	Meter Te	a 6	6			-	109	_	110	011	110	///	11.2	113	11.12	11.3	42	"3	113	113	1322	Negative	3/0	۲, د ۲	,			
STA(VTE 02-	NOZZLE (SIZE.A	PRESSURE	RECTION	Orifice A H		╁	0.50	ļ			53.0	53	0.65			060	0.90	0.30	060	0.95	0.93	10.23	0.95		Positive	¥,0	- مح	16.0	7.0	0	180
	TEST DAT	NOZZLE NOZZLE	STATIC P	PORT DIR		Req d. (sr. H20)	┼	20,	6		10 KJ	53:0	083	0.55	10.55	0.70	05.0	050	060	06.0	0.21	1095	0.95	29.0	PITOT LEAK		Before	Age.	200	8	8	2
	y	5,04	1717	a	Pitot A P	(ii. #20)	1	 																	,		, -		_ ,			
	546 10ac	12	CONTROL BOX OPERATOR	RESSURE 2	Dry Out	Mater Reading	641.49																		ECK	DOM Pute	(c(m)	30.5	000			
	BATTELLE	T NO. 7	OL BOX	BAROMETRIC PRESSURE	Tine.		04:11		_				19:40	`					13:40		•				LEAK CHECK	Vacrete	(in. Hg)	0.0%	20.02			
	CLIENT	PROJECT NO.	CONTR	BARON	Traverse	Point inches	8																		SYSTEM			Refore	7			AQE 1/17

n on n	HOT BOX NO. # /	FILTER NO. BY ASS VET 4.1 STACK DIA. 1847][Temp.	Τ	DIST TOTAL			CONTRACTOR	Theist AH = 17 #20				なれてもつくれる	# 93-M285	\$ 98-M286	1		アンタイ	Fetimates:	1.9 C =WM	1 1	4		laikiel Difference						7	KEYSTONE	
			Impiager Ho		Ļ	657 Acr	35.50		SON AND	+	1	-		77			-	-	10 0	1	+	+	-		Final			_					
	0.902	00.8%	100		_	×50 / 460		10	2	-	1	-	-		-	2.362 =	١	-	Man	7	-	+	-			_		-			<u> </u>		
EET	RECTION	SECTION OX NO.	Ш		+	\		326	186	386	295	337			-	F	2	$\frac{1}{1}$		-	-	+	+	Ingringer	Contents								
STACK SAMPLING DATA SHEET	ORIFICE CORRECTION METER CORRECTION	PITOT CORRECTION			+	7	+	160 2	7	20.00		\overline{a}				7/0				+		+	1	Impinger	, d	-	-	•	\ \ \	97	1		
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K SAMI	29-93	IC DO	96/0	al month	E.	119	112	13	114	8"	811	2//				1	7									and and		}	2				
STAC	E O Y	SIZE, O RESSURE	2015 1015 1015	Act.	(in. H20)	0.9.5	0.95	201	1.06).O	0	0,7				100	20.16						<u> </u>	Cuerre		PATE NO.			- -	2,0	द्य	38.0	
	TEST DATE	NOZZLE (SIZE, 1) STATIC PRESSURE	PORT DIRECTION	Oralice Req'd.	(je. H20)	025	0.25	1.00	1.00	90 /	00,	0//					\$ (E										No.	4		5	8 8	3 %	
	7		200	Pica 4 P	(e. H20)																			_	r		- ,		_	•			
	٥١.	1114	SSURE 250.	Dry Ges Motor Rending	(qc)			925.110	012.00	7			801. 410.	31			A =83,561	get	}						¥	DOM Rete	(ctra)						
	JA 17846	PROJECT NO. 43 COVE CONTROL BOX OPERATOR	BAROMETRIC PRESSURE	Tine		04.41	•	1300	╁╌	┰		1777					V=20	mei							LEAK CHECK	Vector	G. He						
	CLIENT	PROJECT	BAROM	Travere	(i.e.			J. 400		777//								<u>.</u>							SYSTEM	ļ 		Before	AAer				AQE 2/97

			KEYSIG	NE EN	IKONME STA	CK SAM	PLING D	S / AIK ATA SHE	WALLI EFF		KETSTONE ENVIKONMENTAL RESOURCES / AIK UDALLIT ENGINEEKING STACK SAMPLING DATA SHEET		Page 1 of 7
CLIENT	n Sallell	9		TEST DATE	TE 2-29	9-93		ORIFICE C	ORRECTI	ONFICE CORRECTION (A HØ)	12.001	HOT/COLD BOX NO.	BOX NO.
TEST UNIT	.	5		TEST NO.	N-5B	<u> </u>	121	METER CA	PRECTIC TON DAT	N (Y) (O)	3812	PROBE NO	
TEST CREW	CREW D.	15045 D. Som			RESSURE			PITOT CORRECTION -	RECTION			STACK DIA.	نان
BARO	METRIC PR	BAROMETRIC PRESSURE 28	.83	PORT DIRECTION	ECTION			CONTROL BOX NO.	BOX NO.	Box b	Marree	PORT SIZE	
Traverse	Time	Dry One	Plot AP		18	Meter Tea	perature	Vectors	70	Probe	Impinger	Γ	Comments
		Mater Parading (\$£0)	(is. H20)	(fe. H20)	Actual (is. H20)	라()	\$ E	(i. Hg.	7 (*)	Temp.	Temp.	Temp. (*F)	
	9 1 1	821.02\$	}-	۲,2	4,2	146	9.6	5)-		1901		min./point
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	CDE			7.4	って	(13	96	9)					
	1216	75 X		2.4	7.d	117	707	١٥					
	1220			2.4	かて	171	104	16					
	22	_		7.4	7,7	122	105	<u>و</u> 	 				
	740	←-		74	7.4	124	ナリ	و					
	1250	884	-	7-7	アイ	ואתו	105	و					
	13.00)	899.3		7.4	h.2	125	1001	16					
	210	46x.4		2.4	2.4	135	110	160					
	132	47.4		7-7	ት ፕ	5<1	110	و					
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	1430	1,529	-	_		755	110	16					#H20-
SYSTEM	LEAK	СНБСК		PITOT LEA	K CHECK			Impinger	Impiegor	Ł			
	Vacuum	DOM Res			Positive	Negative	_	ż	Contents	콩	Finel	<u></u>	Difference
,	(F. Hg)			Pefore									
Perore	3	0.000		Affec]]		~i					
4	\dashv	10.00	_	30	-	2		ri\.					
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Page 2 of 2	NO.		1			Соппец		min./point		•												nter:		å		Difference	Ţ	<u> </u>	T		<u></u>	767	
Page	JU 2 HOT/COLD BOX NO.	PROBE NO.	FILTER NO.	STACK DIA.	PORT SIZE	_	Temp. (*F)		\ \				_									Estimates	MW	V SH20-		Jaikin) Diff				-	-	AQE 6/92	
EERING		4817	22	S	1	Impinger	Temp.	Tec. 1-	1																	Final							
KEYSTONE ENVIRONMENTAL RESOURCES / AIR QUALITY ENGINEERING STACK SAMPLING DATA SHEET	ORIFICE CORRECTION (A H@) 2.		NTE (0-9.	ON -	O. Box lo Mourae	Probe	Temp.	+	/															,	Impiager	Contrats							
IR QUALISHEET	CE CORREC	METER CORRECTION (Y)	CALIBRATION DATE	PITOT CORRECTION	CONTROL BOX NO.	m Stack	3 1	╟┷						_			<u> </u>	<u></u>		-										1			
URCES / A	ORIFI		CALIE	PITOT	NOO	We Veces	CF)	-		2)	51 1	1 15	י											Impinger	Š.		7	ค่		•		
IMENTAL RESOURCES / AIR QU/ STACK SAMPLING DATA SHEFT	29-93	8-14-729	.	1		Meter Temperature	a 6	7	27 11	177	127 11	127 11	111/20	120												Negative			7				
RONMENT STAC	12	1	1 '	C PRESSURE -	DIRECTION -	Ordice A H	Ge. H20)	די ל	7.7	ン・イ	4.5	7.4	7.4	2.4											LEAK CHECK	Positive N			-	$\frac{1}{1}$			
ONE ENVI	TEST DATE	TEST NO.	NOZZLE (S	STATIC PR	PORT DIR	Orific	1 3	╬	12.01	7.1	42	12-4	J. C	7.u											PITOT LEA		Before	After	OAS	205	8 8	3 2	-
KEYST					8.88	Pitot A P			/	-	_						-	-	-	-	_	ļ			<u> </u>								
	POE.		2700-	12002	ESSURE 2	Dry Oe	Meter Rending	9 88.8	5.260	10%	0.15.5	10	125.10	\sim	3										EQ.	DOM Rate	(cfa)						
	CLIENT Rolling DOS	UNIT 52	PROJECT NO. 92	C	BAROMETRIC PRESSURE	Time		MIN	1050	15/0	1510	520	1530	カクベカシノ)	-			<u> </u>						M LEAK CHECK		F. H.	+-					
	CLIEN	TEST	PROJE	TEST CREW	BARO	Traverse	P. S.	ŀ	<u> </u>										_	1	1				SYSTEM			Before	Ale]			

C FACTOR C FACTOR C FACTOR PROCESS WEIGHT RATE SAMPLE FILTER PROBE WASI- TARE WEIGHT TARE WEIGHT TARE WEIGHT TOTAL	TEMPERATURE OF GAS CONDENSER OR In. My VELOCITY TEASING YACUUM TO SHE WAS ASSESSED.	67 19.5	さつ			72 217	21.8	74 22.0			she stifted The	ch. 22 mails of wind the rop	comment 23" = 119" comment of Contract
28.93	SAMPLE BOX TEMPERATURE	454	257			202	268	259		0.06/	COMMENTS MOTHER	hop the star	140,10 06.001
DATA BIENT TEMPERATURE ROMETRIC PRESSURE SUMED MOISTURE, 8 CZLE DIAMETER, In. ACK DIAMETER, In. ACK DIAMETER, In. ACK DIAMETER, In. ACK DIAMETER, In. ATER BOX SETTING	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (Tm _{out}), F	84 63	63 63	+	+-	84 84	98 98			les B. Chest. Defers. 0	eith b	-	
A TE 73 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	PRESSURE DIFFERENTIAL ACROSS ORFICE METER (AH) In. H, O VOLUME ACTUAL DESIRED (Ym), fis	587924 (01)	8000	b KKAID	632.8	647.5	669.	6.96.0	718.257 - 587.924	(524/53)	ASUREMENT TI	╅┸┸	1;
PAHIIC PLANT TURN DATE 2/31 LOCATION E. OPERATOR E. STACK NO. NO. NO. NO. NO. NO. NO. NO. NO. NO.	VELOCITY HEAD (AP.) (\(\(\(\(\(\(\(\(\(\(\(\(\(\(\(\(\(\(\	077	1.40			07.7	7.60	0.87		Suche limbs	SILICA GEL WEIGHT, DRSAT M		
STACK Optiumander STACK STA	STACK STACK ORE TEMPERATURE (T.), .F	7 302		7	<u> </u>	3 301	1 1	306			NAPINGER VOLUME mi		· !
SCHEMATIC OF STACK	SAMPLING STATE THE (6), min. thr. 1730]	20/13:10 26	57.22	34.6	14:02	95 14:17 21.3 110 14:32 27.3		20.5	/Mi36	L L	VOLUME OF LIQUID	FINAL	TOTAL VOLUME COLLECTED
	TRAVERSE POINT NUMBER									TOTAL			10141

CLIENT SATTRALE 100E TEST UNIT STALE 1401	\$ 577846 \$ 577849	1000	. 30	STA TEST DATE OF TEST NO. N 572 NOZZI E (SIZE A)	STACI	STACK SAMPLING DATA SHEET 1 02-3/-93 (S.f.) ORIFICE CORRECT 1 0 1 59 CALIBRATION DATA 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	(PLING I	OATA SHEET ORIFICE CORRECTION METER CORRECTION CALIBRATION DATE	HEET ORRECTION DATE	di	202	Page HOT BOX NO. COLD BOX NO PROBE NO.	NO. #2	
CONTROL BOX OPERATO BAROMETRIC PRESSURE	BOX OF	PERATOR 7	3.06	STATIC PRI PORT DIRE	ESSURE	N N	0 20	PITOT CORRECTION CONTROL BOX NO.	RRECTION BOX NO.	N 0.84	7	FILTER NO.	132	南南
	1	Dry Oak	Pitet A P	Original Property of the Prope	Ges A H	Meter Te	aperature	Vector	Sheck	Probe	Impiager	Hot Box	Comments	
, o		Moter Reading	(i- H20)	Req'd.	Act.	4 E	0 S	. H.	įE	Temp (*)	Temp.	7. (F)	_	
30	8	030.700	2	130	061	63	9.3	12.0	20	2000	48.0°	7 085	Single Aut	 -
╁	3			9/1	0/:/	20	23	0 61	203				LOU BOTHONG	
		į		145	7.43	93	16	12.0	580				Onix lasains	
				1.45	145	93	16	0.01	385				Wes ToraL	
				1.45	1.45	46	86	0.0	30				THESAT AH	
	,			1.4.5	541	7,6	22	00	25.5				1.4 110	
	8.00			1.45	1.45	46	92	12.0	25.4					
				1.45	54.	7.6	66	12.0	255					
				18	8	9.1	6.9	/e. 5	38.5			:	Han Fronce	
				1.50	1.50	93	93	16.5	25.7			1.15	Shir Marc	
				04.1	04.1	25	5.3	16.0	28.5			133	They test by	
				01.	1.40	96	93	16.0	26.5					
	14.00			1.40	04.1	015	93	16.0	25.5		6.16	#	-192733	
				0/1	0/1	12	25	135	255			#33	MZ87	
				04.7	06.7	57	9.5	155	285			# 93 - 128 Estimates	Estimates:	
				1.40	ah-1	65	53	15.5	200				N	
				1.40	1.4C	9.7	95	15.5	265				\$H20- 7.0	
				1.40	0.7	98	95	15.5	25%					_
SYSTEM LE	LEAK CHECK	¥		PITOT LEAK		13.05	•	Impiager	Impiege	<u>.</u>	7	Labia	Difference 127	77.59
	Vacuan	DOM Rate			Positive	See See		<u>.</u>	3 3	12.1	16.10	1 Cud 1		0
	G. He.	(clm)		Before	*	·			James (0)		10,00	2/100	٦.,	> 4
_	0.0	۲.0 ک		Affec	ر دو –	90		'n	1	200	443,1	435.4	7.2 M	~
	07	110-2	7	200	14.0			4	Sille	39	699.0	659.5	39.5 Mashe =	اراء 11
				8	5.9		_	5					7	4.29
				8 2	7.5							¥ س	KEYSTONE	, Š
A OF 2/62													The second second	

Page 2 of 2	HOT BOX NO. 7=2 COLD BOX NO. 4= 2-	PROBE NO. 5-/	FILTER NO. BUM35 NOT	STACK DIA. 722	Hot Box Comments		-250x Swell Aut	NON BOTHER	con/ann	44AC 18TAL	THESOT ALL	14" 420				93	# 93-11288			·	Estimates:	MW= 29.5	8H20- 9.0							7-7	KEYSIONE	,
-	CTION 1.802	0	1 !	NO. 561.00	-	(*F) (*C	5 -350 4 468 Den	J.					5				7.98= ") the							Contents Frank		•					
STACK SAMPLING DATA SHEET	ORIFICE CORRECTION METER CORRECTION	CALIBRATION DATE	PITOT CORRECTION	CONTROL BOX NO.	store Vectoral Stack	13. T. T. T. T. T. T. T. T. T. T. T. T. T.	15.0	657	N.O.	14.5	14.5	14.5	97 N.5 265				- 95Pc 1/a							Impieger	X 0.		7	F)	• •			
TACK SAMPLII	91	TA CAR	1	160	╟	Act. In Co.	36	90	36	8	3	66	66				12 15	9						AK CHECK	Positive Negative			1 2	(4.0	201	17.5	
S	TEST DATE		ľΔ.	O' PORT DIREC		Paris.	3,		}	-			-				TV							PITOT LEAK		Before	Alber		203	8 8	N2	
	1000	100	PROJECT NO. 13COUR TO	29		Mater Reading		3					00:7/	00000000	7		1	707	1	/m/m				LEAK CHECK	Vacana DOM Rate		-					
	CLIENT SATISTIC	TEST UNIT	PROJECT NO	BABONETE	T. T. T.		3							<i>o</i> , <i>i</i>			1/1/2	1	7.10	E				SYSTEM LEA			and and	Aber			AQE 1/91	

Data Sheet	
Sampling	il Crook
Dilution	OF COS
Chester Environmental Dilution Sampling Data Sheet	Rattelle/DOE_Coal Creek
Cheste	

۵ 2 6 HEST Impactor Filter IDs: 8×10 Meter Box AH@

Nozzle Diameter (in.)

Dilution Ratio Pitot Coeff. N-5 B-726 Barometric Pressure (in. Hi Ambient Temperature Run Number Location Operator Date

	8	
1		
	4	
}	\neg	
	Static Pressure (ln. H ₂ O)	
	(la. H ₂ O)	
	Pressure	
}	Static	
Ī	\neg	
	Hg)	
l	H	

				_		-			—					,				
Diluant	Press. (psig)	\$	رو	9/	9/	91	16	91	72/	76	10	15	16	2	و	<u>.</u>		
Ö	Temp. (*F)	ž	ક	201	192	201	0	102 14	101	41	201	70)	101	101	100	$ \omega $		
	Meter Reading	164.0	179.1	195,0	208.2	2,69,1	F1822	236.6	244.1	256.1	212.8	176.9	288.7	3010	311.4	322	607	
Meter Box	Vac. (in. Hg)	ک	L	5	5	5	5	٧	5-	6	5	7	~	5	W	5		
Mete	Temp (*F)	725	125	Pies	125	125	125	125	125	125	127	121	125	125	52)	(25		
	ΔΗ (in. H ₂ O)	1.55	1,55	(1:56)	1.56	1.X	1,56	1.52	1,56	15,	1,5%	1, 14	1.76	1.52	11.12	1.50		
Orifice	Press. Drop (in. H ₂ O)	かが、	ブァ・	٠4٩	١ ۲۴	۱۲۷ ،	<i>b</i> h'	، ۲۷	١ ٢٩٠	77.	7/7	1,14	カカ	.46	, 44	, ዛಳ		
δ	Vacuum (in. H ₂ O)	11-	-11	-11	-)1	~11	h-	11~	-11	-11	-11	-11	11-	-((11-	-11		
Ž.	Temp (*F)	211	211	113	113	113	())	11.5	112	113	17	113	112	गा	113	113		
Chamber	Press. (in. H ₂ O)	2,67	2.67	2,67	2.67	2.67	2,67	2.6.7	2.67	241	2.67	2.67	2.67	2,67	2.67	2,67		
3	Press. Press. Press. (in. H ₂ O) (in. H ₂ O) (in. H ₂ O)	11.(111	וינ	1.1	111	1/1	ht	1, (111	1	111	1.1	100	1,1	111		
Clatic	Press. (in. H ₂ O)	0')-	0' -	011-	0']-	. j, u	-1،6	-1tb	۔[نم	-1.0	-1.0	- 1.0	2.)-	0,1-	0'J-	01/-		
Par Par	Temp.	300	301	304	302	305	307	301	306	367	209	362	309	307	300	Š		
1000	18 19 19	862	101	782	282	687	291	267	908 362	762	962	294	273	162	962	053		
1		86	36	θЬ	86	25	16	16	95	96	56	156	Sb	95	طد	20		
	Tine Si	270	285	380	کابر	330		3	3/6	340	30h	ρZh	sth	8/2	465	480		
	Clock	1530	15.45	98.	1812	1630	52.91	1300	31/1	1730	53.67	2987	5191	06.81	18.65	(400		

99COLE.FOL 9 (see also 181005-2.FOZ)

٦	Coal Creek Run	No. W-58-77	7	Date	7-27	-93
j	Use defaults as r	equired for presampling	setup.	Operator	· ·	
1	Obtain by	Parameter	Value	Unit	Nomen.	Default
]	Calibration:	Probe Coeff. A	6.3425	-	Ap	See probe
}		Probe Coeff. B	1,8168	-	B _p	calibration summary
j		Probe Cal. Temp.	68	°F	T _{csl.p}	68
7		Probe Cal. Press.	29.92	in. Hg	P _{cal.p}	29.92
j		Orifice Coeff. A	0,0018	-	A _o	0.0018
)		Orifice Coeff. B	1,9897]	Bo	1.9897
}	Ba 5	Orifice Cal. Temp.	68] • F	T _{cal.o}	68
1	CAC 5-17-93	Orifice Cal. Press.	<u> د۹،۹۶</u>	in. Hg	P _{cal.o}	29.92
	YPACTON: 11.9832	Meter Box ΔH@	1.734	in. H ₂ O	ΔH@	1.7
2		Pitot Coeff.	0,84]-	C _p	0.84
}	Measure:	Ambient Temp.	88	°F	Ta	90
_		Barometer	28.94	in. Hg	P_b	29.92
		Stack Temp.	287	°F	Ts	220
•		Static Press.	10	in. H ₂ O	P_s	-1.5
		Velocity Press.	111	in. H ₂ O	VP	1.8
'		Stack Moist.	9	% vol	H ₂ O	17.3
]		Chamber Temp.	160	•F	T _C	90
J		Orifice Vacuum	-11	in. H ₂ O	$\mathbf{v}_{\mathbf{o}}$	-15
1		Meter Box Temp.	105 110] ° F	T _{dgm}	100
J.	Specification:	Dilution Ratio	30]-	DR	30
1		Nozzle Diameter	1178	in.	d	0.178
j		Impactor Rate	75	actin	Q_{i}	0.75
1	Calculation:	Stack Velocity	4245	ft/min	V_s	
1		Probe Flow	0.7336	acfm	Q _{act.}	
1		Probe Flow	0.5003	scfm	$Q_{\text{std.}}$	
1		Chamber Press.	Z.6680	in. H ₂ O	P_C	
1		Orifice Flow	16173	acfm	Q_{oa}	
}		Orifice Flow	14.83	scfm	Q_{os}	
1		Orifice Press. Drop	0,4294	in. H ₂ O	P_{O}	
	03/9990 EAL (ass also (Meter Box ΔH 22C042.F01, 181025-2.F01)	1.57	in. H ₂ O	ΔΗ	
j	Revised 06/16/93		TE: 01	945		CHESTER
}	۲	DATE:	7 - 2	5-93	VAC -	5"4

1	70							Diluant	Press. (psig)	16.5	16.5	اق	16.5	16,5	16.5	16,5	16,5	5:5	15.0	16.5	15.5	ठब	5	وزع	16.5	16.5	16,5	Revised O6/16/93	
7	41	-727						Dig	Temp. (*F)	-95	93	47	3	2	44	7.6	ž	9.1	4	46	20	4.4	25	9.6	44	95	35		
}	30.64	- MUM -		5	9	7	*	32.905	Meter Reading	Section 1	L'KE &	3.46.0	356.9	3,64,0	380,7	392.3	404.3	415.9	488'4	4383	0'15h	463,1	475.0	1.36.1	497.2	508.8	1,025	(RATE + VAC)	
1	et Mks:	1-85					-	Meter Box 3	Vac. (in. Hg)	4,5	۲۶۶	4,5	4.65	7,5	4,5	-5'3	21 12	4,5	4.5	415	5,5	414	217	4,5	4,5	3	5	گ ک	
}	Data Shee	N-SB	1	7	7	m	4	Mete	Temp. (*F)	110	112	115	115	115	115	233	9:-	3	911	3€	26	16	116	9	911	-3	=	10	1
}	g Data	8×10	HEST	Impactor					ΔH (in. H ₂ O)	251	1.57	1.57	15.7	(18)	1,56	251	251	1, 52	4,5	1,56	25	1176	1.56	(156	1.8	1.56	(,56	2000	1/2001
}	tion Sampling Data Sheet Coal Creek % 4,0= 92,	Filter IDs:					_	Orifice	Press. Drop (in. H ₂ O)	54.0	0,73	0.73	0.13	6.13	0,13	0173	0,73	0,43	0,13	0, 13	0,43	0, 73	0, 73	0.13	0.43	0.43	0.73	TEST 0	10 tout
}	Dilution S OE—Coal			,73(0,178	2	-	ō	Vecuum (in. H ₂ 0)	17	-11	-ار	11-	-11	-11	-11	-11-	7	-	=		5	11-	1	-11	=	7	Pre-T	3000
1			0.64	1		30	. H ₂ 0)		F. C.	3	10/	603	10%	101	104	107	107	105	105	105	103	104	<u>रु</u>	104	104	<u>8</u>	701		
}	onmental Dil Battelle/DOE	:		Meter Box AH@	Nozzle Diameter (la.)	n Ratio	Static Pressure (in.	Chamber	Press. (in. H ₂ O)	2,67	6.67	2.67	746.1	2.67	2.61	2.61	7.67	2,67	7457	2,57	2,67	24.2	2.67	2,67	2.67	2.67	2.67	CHECK	
]	Environmental Battelle/D		Pitot Coeff.	Meter	Nozzle	Dilution Ratio	Static	-	Press. Press. Press. (in. H ₂ O)(in. H ₂ O)(in. H ₂ O)(in. H ₂ O)	2		ניו	1 1	101	fe 1	1,1	12	1.1	111	111	14	11.1	13.3	11.1	111	1:1	=	LEAK (
1	ester E	[[<u>-</u>	Γ-	Ţ	П		Press. (in. H ₂ O)	0 -	0)	2 ·] -	P-1-0	-10	Q')-	-116	-1.0	-10	-1.0	q11-	-1.0	-1,0	-)r	017-	-1.0	6.4.	-(10	!	
,	Che			27			18/87			_	N. Y.	3/7	128	122	728	324	27.1	128	n	378	125	F28	728	375	325	328	324	MARACAR	
				7	1,44	200	n. Hg)			282	782	29.9	285	187	3.55	385	287	286	432	787	286	782	187	162	230	290	682	ĝ	
		7-27-93	25	N-SR		xrature.	essure (i			å	8	8	\$0	88	550	83	8	88	88	88	88	88	84	88	280			181005-2	
	X	1.5	1	Run Number	ğ	Ambient Temperature 2.5	Barometric Pressure (in. Hg)		Samp ling of		2 2	3.	75	3	1 %	8	707	123	135		ı	287		3	225		155 90	5)COOS. POZ 9 (nec also 161025-2,702)	
	10.17m Thereis Po : 2.67 Po : 43 OH - 1.57	0	Location	S and S	Operator	Valgi.	Вагоп		Clock	1 100	430	378	8	2,6	3/6	945	10x	701.5	00.	10 40	=	3	1:36	575	ž	22.5	052)	SCOR P	
1	15 Croc D							پي ح.	1	<u></u>																			

· [Diluant	Press. (psig)	6,5	16,5	او لا	رو، ۷	اذ	16.5	16.5	16.5	3	16.5	19		S 9	ا <u>ڤ</u>	ود	او	3.9/	
		-	{						E E	36	9	3	8	۲		3	92	Š	9	7	ō	9	g	힐	9	9	
		}	2	9	7	80			Meter Reading	5.32.9	51413	557.0	\$67.8	578.3	591.6	60361	+	-	+		+	_	-	-	-		_
								Meter Box	Vec. (in. Hg)	4,5	7,5	۲,5	3,6	4.5	23	۲,5	-	7	-	7	1			-	-	-	_
Sne			~	7	3	4		Mete	Temp. (°F)	9//	117	118	917	3	2	52		1		7		-			-	-	_
y Data		HEST	Impactor						ΔH (ln. H ₂ O)	7,58	75.7	1152	1:56	1.52	156	1,56	1	1	-				-		_		
Environmental Dilution Sampling Data Sheet Battelle/DOE—Coal Creek	Filter IDs:						\ 	Orifice	Press. Drop (in. H ₂ O)	0,43	0.43	0,43	Ory2	947	0.17	130		6,77	0,72	22.0	۲۲.5	0,47	0,47	0.72	0,47	6,47	
ition S -Coal								Ö	Vacuum (in. H ₂ O)	11-	-11	-)(-	- ((=-	7	7)-	-11	-11-	71-	=	11	1/-	-	11	=	7	
NOE POE				ੁੰ ਜੁ		. H,O		Ser	of (F)	105	106	105	fox	194	105	105	107	108	B	Lav	101	109	ŝ	90	2	107	
onmental Dilt Battelle/DOE-		eff.	Meter Box AH®	Nozzle Diameter (in.)	n Ratio	Static Pressure (in. H,O)		Chamber	Press. (in. H ₂ O)	2:61	2.67	2,67	2.67	2,67	2.67	2.67	2.67	1,2,2	7.67	7.57	7.67	79.2	160	2,67	2.67	2.67	
nviron Bat	Į	Pitot Coeff	Meter 1	Nozzle	Dilution Ratio	Static P		3		-	1,1	ויי	1,1	111	(1)	1, 1	11	7.1	1:1	11	1		1,1	1-1	177	7	
e.			Γ-	T	Γ.	7	ا ا		$\overline{\hat{\mathbf{x}}}$	9	017	110	۲ (۵	- 1 is	-1.0	-1.0	-1.0	E 1 -	21.0	-10	01)-	011	11.0	-1.0	- 1,0	011-	
Chest			_					3	Ten o		32.1	324	3%	۲٦٤	128	324	326	327	37.5	317	326	324	324	328	325	32 4	
	7		3-727			E E			Temp.	_			_	264	287	267	162	293	794	167	293	142	162	762	296	243	
	7-27-93	513	4 . ^	1	Praftite	de la contraction de la contra		•		90	96	ē	6	6	90	6	93	46	Sh	l -	95	36	45	ماد	86	35	
	7	1	قِ)	Ambient Temperature	Parometric Pressure (in He)			ing in	270	265	\$ 6	2/5	3.00	3,5	27.6	315	39€	۸۵۶	02h	٤٤٨	es h	59h	283		SIC	
	Date	Location	Ž	0					Clock	3,00	200	17.0	132	É	Ş	212	2,5	<u>ک</u> رکز کرکز	8	215	5.30	15.45	009)	1910	23	645	. –

	Coal Creek Run	No. 14 50 719		Date	7-28	
		المستحدثينا		Operator		-72
,	-	required for presampling		_	L-7	
-	Obtain by	Parameter	Value	Unit	Nomen.	
,	Calibration:	Probe Coeff. A	6.3425	_	A _p	See probe calibration
1		Probe Coeff. B	1.8168	-	=	summary
)		Probe Cal. Temp.	68	°F	T _{cal.p}	68
7		Probe Cal. Press.	29.92	in. Hg	P _{cal.p}	29.92
j	801-5 JAN 5-17-97	Orifice Coeff. A	010018		A _o	0.0018
1	801-3-17-97	Orifice Coeff. B	1.9817	-	Bo	1.9897
]	CAC	Orifice Cal. Temp.	68	°F	T _{cal.o}	68
1	0.9837	Orifice Cal. Press.	29.92	in. Hg	P _{cal.o}	29.92
}	March	Meter Box AH@	11734	in. H ₂ O	AH@	1.7
ז		Pitot Coeff.	0.84]	C_p	0.84
	Measure:	Ambient Temp.	8B	°F	T_a	90
, •		Barometer	28.96	in. Hg	P_b	29.92
}		Stack Temp.	289	°F	Ts	220
•		Static Press.	- 195	in. H ₂ O	P_s	-1.5
1		Velocity Press.	le l	in. H ₂ O	VP	1.8
,		Stack Moist.	9	% vol	H ₂ O	17.3
}		Chamber Temp.	103] •F	T_C	90
j		Orifice Vacuum	-11	in. H ₂ O	v_o	-15
1		Meter Box Temp.	105]°F	T _{dgm}	100
j	Specification:	Dilution Ratio	30]	DR	30
1		Nozzle Diameter	178	in.	d	0.178
1		Impactor Rate	, 75	acfm	Q_{i}	0.75
1	Calculation:	Stack Velocity	4180	ft/min	V_s	
ł		Probe Flow	0,7224	acfm	Q _{act.}	
1		Probe Flow	0.5080	scfm	Q _{std.}	
1		Chamber Press.	2.6612	in. H ₂ O	P_{C}	
_		Orifice Flow	16,493	actm	Q_{oa}	
		Orifice Flow	15:050	scfm	Q_{os}	
		Orifice Press. Drop	0.4297	in. H ₂ O	P_{O}	
		Meter Box AH	1.596	in. H ₂ O	ΔН	
•	Revised 06/16/93	92C042.F01, 181025-2.F01)		 >4 \$	(1)	CHESTER
	Ť	SDS LEAK RI	~!~ ·	5-13	VAC .	2, Hd
*		DATE				•

01/C (510 1 50 15,0 15,0 5.0 (psig) 3.0 130 15.0 150 15.0 15.0 1510 Dilumot N-58-MM5-728 9 2 6.5 CED C 9 62 25/6363 46 MW = 30.68 25 649 2,5 [616,61] 46 6000 g 67:106 653.0 197 1615: 158 25 73.1 756,1 ø ~ 00) Vac. Meter (in. Hg) Reading 12879 12 2,5 698,7 254775 721.1 2.5-710.3 2.5 15.5 5.2 2,7 ~ ~ 2.5 Meter Box Chester Environmental Dilution Sampling Data Sheet 3 1 Ē, 2 HD=89 2,60 100 ā <u>0</u> 9 <u>ه</u> 20 ≆ 1621118 _____ ≱ 1 60 (6) ~ m Impactor 1 152 1,62 791 791 Filter IDs: | 8×10 HEST ΔH (in. 162 12.5 7.62 (E) 1,52 H,0 . ? 100 Vacuum Press. Drop (in. H₂O) (in. H₂O) Battelle/DOE-Coal Creek 51,10 64.0 o Ç 0.43 0.13 S × 0 0.73 67.0 ×, 3, 0173 0.13 6110 0 17 5 Oriflee 56 - -1-Nozzle Diameter (in.) O. 778 --Ť = ! = ī = - = <u>-</u> 1,731 Static Pressure (in. H₂O) 105 5/2 5 105 53 (in. H₂O) (in. H₂O) (in. H₂O) (*F) 00 100/ o c c 63 9 2.66 103 ह 75 ایور \$0 Chamber Meter Box AH@ 2,66 2.6% 2.64 7912 2,66 2,66 2.66 2,66 7.166 2,65 2066 2.66 25.6 Dilution Ratio Pitot Coeff. Press. Ξ 1 **):** <u>-</u> ت 2 Ξ 1 03 -3 161--195 . 95. 195 55'-017 2 Static Press. - 195 5 1,05 97 Barometric Pressure (in. Hg) 28 9 6. 725 Probe Temp. (°F) 725 324 324 **32**8 725 323 525 324 326 324 200 32.4 772 -723 **L82** 288 183 787 Stack Temp. (*F) **LB2** 281 **ુ**હ્ર 180 289 1387 33 187 55. 75. <u>8</u>2 Ambient Temperature 90 Run Number 11/-573 3 Amb. 90 7-23-73 25 £ 3 위 63 SB 9 6 25 8 ő 33 à Samp-ling Time 35 इ 07.7 75 30 3 Location Operator 1075 1036 Clock 1015 12 = 2.66 Po : 43 900 € ≅ 30 Date 36 8 001.1 = H.

(RATE & VAC) Amind OSCIGOTO

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Data Sheet	8×10	HEST	Impactor 1	2	3	4	
ipling reek	Filter IDs: 8×10		,		 -	ر ۔ ۔ ،	
Chester Environmental Dilution Sampling Data Sheet Battelle/DOE—Coal Creek		Pitot Coeff.	Meter Box AH®	Nozzle Diameter (in.)	Dilution Ratio	Static Pressure (in. H ₂ O)	
Cheste	200	Totalian 14 CD 1728	Dun Number	in the second se	A mhient Termerative	Barometric Pressure (in. Hg)	

Barometric Pressure (in. Hg)

									_						
Diluant	Press.	(psig)	15.0	1500	15.0	2.5	(5.0	15.0	15.0	5.0	5,3	15.0	15.	15,0	15.0
ľΩ	Temp.	(F)	101	101	101	101	10/	101	101	101	101	10 F	19	102	701
	Meter		1.62 118 2.5 307.3	2,5 810,6 10!	5'086 5'2	102 118 2.5 By 1.3 101	2.5 852.7	2,5 8,5,4 10 1 15.0	25 876.2	2,5 \$316	75 B984	2.5 910.7	25 722.3	2.5 933.7	2'446
Meter Box	,	(*F) (in Hg)	2,5	2,5	2,5	2.5	2.5	2.5	272	5.5	7.5	2.5	2.5	5.5	2.5
Mete	- GILL	C-F)	118	118	811	311	911	118	81)	811	118	118	118	611	611
	AH An	- 1	1162	7911	811 291	1,62	1.62	191	162	1.62	19.1	191)	751	291)	1,62
Orifice	Vernim Dree Dren	(in. H ₂ O) (in. H ₂ O)	EA.O	61.43	540	6143	Ø. Y3	Chio	6,43	5,0	CHO	6, 43	5410	643	643
ŏ	Vernim	(in. H ₂ O)	2, 1/2 100 Ball 3	//-	=	17	١	7	5	=	=	1	7	-	=
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Chamber	2	<u></u>	2,46	2,65	2,56	2,62	2.66	246 108	25.56	2.5.	2.46 100	2,66	2,66 (08	2,64	1
	<u>₹</u>	(ia. H,O)	-		1		3	\ \.	3	12	1.3	7,7	3	3	1-1
	Static	(in. H,O)	35	-,95	36'-	27,-	25'-	9 -	\$6.		,	36'-	9	74	75,7
	Probe			325	328	327	176	124	323	325	373		217	226	275
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Revised 06/16/93

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Obtain by Parameter Value Unit Nomen. Default	,	a .a		•	Date		
Obtain by Parameter Value Unit Nomen. Default]		للنتسطين				9-93
Calibration: Probe Coeff. A Probe Coeff. B 1.8168 - Bp Stee probe calibration summary	5	•		_	-		
Probe Coeff. B 1.8166	Ì	Obtain by	Parameter	Value	Unit	Nomen.	
Probe Coeff. B Probe Cal. Temp. Probe Cal. Temp. Probe Cal. Press. Orifice Coeff. A Orifice Coeff. B Orifice Coeff. B Orifice Cal. Temp. Orifice Cal. Temp. Orifice Cal. Temp. Orifice Cal. Temp. Orifice Cal. Press. Proto Coeff. Measure: Ambient Temp. Barometer Stack Temp. Stack Temp. Cal. Temp. Barometer Dilution Ratio Chamber Temp. Orifice Cal. Temp. Orifice Cal. Press. Dilution Ratio Nozzle Diameter Dilution Ratio Nozzle Diameter Dimpactor Rate Calculation: Stack Velocity Probe Flow Prob	J	Calibration:	Probe Coeff. A	6.3425	_	A _p	
Probe Cal. Press. 29,92 in. Hg Pral.p 29.92	}		Probe Coeff. B	1.8168	-	B _p	
Orifice Coeff. A	}		Probe Cal. Temp.	68	°F	T _{cal.p}	68
Orifice Coeff. B 1.9897	7		Probe Cal. Press.	29,92	in. Hg	P _{cal.p}	29.92
Orifice Cal. Temp. Orifice Cal. Press. Variable V	j		Orifice Coeff. A	810018	-	A_{o}	0.0018
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Price 1.73 in. H ₂ O	}		Orifice Cal. Temp.		•F	T _{cal.o}	68
Pitot Coeff. Pit	,		Orifice Cal. Press.	68 29.92	in. Hg		29.92
Measure: Ambient Temp. 79 °F Ta 90		YMC102-0.9832	_Meter Box ∆H@		in. H ₂ O	ΔH@	1.7
Barometer 78.84 in. Hg Pb 29.92	_		Pitot Coeff.	0.84	_	$C_{\mathbf{p}}$	0.84
Stack Temp. 289 °F T _s 220 Static Press. -1.0 in. H ₂ O P _s -1.5 Velocity Press. 1.05 in. H ₂ O VP 1.8 Stack Moist. 9 % vol H ₂ O 17.3 Chamber Temp. 100 °F T _C 90 Orifice Vacuum -11 in. H ₂ O V ₀ -15 Meter Box Temp. 105 °F T _{dgm} 100 Specification: Dilution Ratio 30 - DR 30 Nozzle Diameter 1.178 in. d 0.178 Impactor Rate 75 acfm Q _i 0.75 Calculation: Stack Velocity 4160 ft/min V _s Probe Flow 14873 scfm Q _{sct.} Probe Flow 14873 scfm Q _{std.} Chamber Press. 2.5578 in. H ₂ O P _C		Measure:	Ambient Temp.	129	°F	Ta	90
Static Press.	•		Barometer	28.84	in. Hg	P_b	29.92
Velocity Press. 1.05 in. H ₂ O VP 1.8 Stack Moist. q % vol H ₂ O 17.3 Chamber Temp. 100 °F T _C 90 Orifice Vacuum -11 in. H ₂ O V ₀ -15 Meter Box Temp. 105 °F T _{dgm} 100 Specification: Dilution Ratio 30 - DR 30 Nozzle Diameter .128 in. d 0.178 Impactor Rate .75 acfm Q _i 0.75 Calculation: Stack Velocity 4160 ft/min V _s Probe Flow .2189 acfm Q _{act.} Probe Flow .4873 scfm Q _{std.} Chamber Press. 2.5578 in. H ₂ O P _C			Stack Temp.	289	•F	T _s	220
Stack Moist. Q % vol H ₂ O 17.3	J		Static Press.	-1.0	in. H ₂ O	P_s	-1.5
Chamber Temp. Orifice Vacuum Orifice Vacuum Meter Box Temp. Meter Box Temp. IOS P To To To To To To To To To]		Velocity Press.	1.05	in. H ₂ O	VP	1.8
Orifice Vacuum Meter Box Temp. Specification: Dilution Ratio Nozzle Diameter Impactor Rate Calculation: Stack Velocity Probe Flow Probe Flow Chamber Press. Orifice Vacuum Imp. H ₂ O V ₀ -15 F T _{dgm} 100 DR 30 in. d 0.178 acfm Q _i 0.75 ft/min V _s acfm Q _{act.} Probe Flow 14873 scfm Q _{std.} Chamber Press. 2.5578 in. H ₂ O P _C	J		Stack Moist.	9	% voi	H_2O	17.3
Meter Box Temp. 105 F T _{dgm} 100	1		Chamber Temp.	100	°F	T_{C}	90
Specification: Dilution Ratio Nozzle Diameter Impactor Rate Calculation: Stack Velocity Probe Flow Probe Flow Chamber Press. Probe Flow Chamber Press. Probe Flow Calculation: Stack Velocity Probe Flow Chamber Press. Probe Flow Chamber Press. Probe Flow Calculation: Stack Velocity Calculation: Stack Velocity Probe Flow Calculation: Stack Velocity Calculation: Stack Velocity Probe Flow Calculation: Stack Velocity Calculation: Stack Velocity Probe Flow Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Veloci	1		Orifice Vacuum	-11	in. H ₂ O	$\mathbf{v}_{\mathbf{o}}$	-15
Specification: Dilution Ratio Nozzle Diameter Impactor Rate Calculation: Stack Velocity Probe Flow Probe Flow Chamber Press. Probe Flow Chamber Press. Probe Flow Calculation: Stack Velocity Probe Flow Chamber Press. Probe Flow Chamber Press. Probe Flow Calculation: Stack Velocity Calculation: Stack Velocity Probe Flow Calculation: Stack Velocity Calculation: Stack Velocity Probe Flow Calculation: Stack Velocity Calculation: Stack Velocity Probe Flow Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Velocity Calculation: Stack Veloci	1		Meter Box Temp.	105] °F	T_{dgm}	100
Impactor Rate 75 Calculation: Stack Velocity Probe Flow Probe Flow 14873 Chamber Press. 2,5578 acfm Qi 0.75 ft/min Vs acfm Qact. Stack Qact. 2,5578 in. H ₂ O PC	1	Specification:	Dilution Ratio	30]-	DR	30
Calculation: Stack Velocity 4160 ft/min V _s Probe Flow 7189 acfm Q _{act.} Probe Flow 14873 scfm Q _{std.} Chamber Press. 2,5598 in. H ₂ O P _C	ı		Nozzle Diameter	.178	in.	d	0.178
Probe Flow .7189 acfm Q _{act.} Probe Flow .4873 scfm Q _{std.} Chamber Press2.5598 in. H ₂ O P _C	1		Impactor Rate	175	acfm	$\mathbf{Q_i}$	0.75
Probe Flow . 48.73 scfm Q _{std} . Chamber Press. 2.55% in. H ₂ O P _C	1	Calculation:	Stack Velocity	4160	ft/min	V_s	
Chamber Press. 2.55-98 in. H ₂ O P _C			Probe Flow	,7189	acfm	Q _{act.}	
,			Probe Flow	14873	scfm	$Q_{std.}$	
Orifice Flow 16,333, acfm Qoa	}		Chamber Press.	2.5598	in. H ₂ O	P_{C}	
			Orifice Flow	16,3331	acfm	Q_{oa}	
Orifice Flow 14,4276 scfm Qos			Orifice Flow		scfm	Q_{os}	
Orifice Press. Drop C. 4081 in. H ₂ O P _O			Orifice Press. Drop	6.4081	in. H ₂ O	P_{O}	
Meter Box ΔH /1, 554 in. H ₂ O ΔH				11554	\int in. H_2O	ΔH	
REVISED DO 16/93		Revised 06/16/93		ATE: 804	(5	4	CHESTER
PSDS LEAR IZATE VAC VAC		τ		 ,		VAC .	>-\

Sheet 4.4. MW = 20.58	N-58-MUM- 729		1 5		3 7	200	Meter Box Diluant	Temp. Vac. Meter Temp. Press. (*F) (in. Hg) Reading (*F) (psig)	101 2.5 972.319 90 15.5	3.51 PB 1.48 2.5 POI	105 2,5 495,1 69 15.5	110 2.5- 006.9 84 15.5	113 25 019,4 88 15.5	115 215 031.2 89 15.5	115 2.5 042.7 89 15.5	1.51 2.5 54.2 89 15.7	11 2.5 66.3 89 15.5	5	115 2:5 89.2 90 15.5	117 2,5 101,3 90 15.5	115 2.5 113.4 90 15.5	115 2,5 124,4 90 15.5	115 25 135,7 91 15.5	115 2.5 11/8,1 91 15.5	2.5	2 25 112,591 16.8	DES (RATE + VAC) Remind Obligan	1011
g Data	1: 8×10	HEST	Impactor					ΔΗ (in. H ₂ O)	1.55	1,55	15231	1.53	95/	18	83,1	1.58	1,50	911	951	1,58	2.58	1,58	1,50	25.7	}	1,38	6.002	0,005/1
tion Sampling -Coal Creek %	Filter IDs:				_		Orifice	Press. Drop (ta. H ₂ O)	0,4	14.0	17.0	0141	0.41	77.0	0.40	0.4(921	5, 5	0.4(5	0.41	50	\$0	14.0	16.4	סיתו	-, 1	POST-TEST D
ution Co.			734	210	30	27-		Vacuum (in. H ₂ 0)		7	11~	<i>J</i> 1 ~	-17	7	17-		Ť	71-1	7	7	1-1-1	-11	=	=	77	-t-	PRE-TEST	Post
A Die		84	7	(B)		a. H ₂ O)	ğ	A C		47	98	9,5	88	96	44	56	98	99	8	99	8	3	3	3	ē	· <u>ō</u>	 V	
onmental Dily Battelle/DOE		oeff.	Meter Box AH®	Nozzle Diameter	Dilution Ratio	Static Pressure (in.	Chamber	Press. (in. H ₂ O)	2.56	2,56	9512	35.5	95'Z	252	95'2	25.5	25.2	2022	45.2	2,56	2,5	21.50	2,38	2.56	225	25.56	CHECK	
Environmental Battelle/D	1	Pitot Coeff	Meter	Nozzle	Dilutio	Static	;	Prist. (fa. H ₇ O)	1.05	701	2,05	1.05	1.05	1.05	1-05	1, 84	ا روحر	1.05	ادوي	1.05	1,05	1,05	1,05	1.05	1:05	ישא	LEAK	
Chester E			·					Press. Press. Press. (in. H-0) (in. H-0)	-1.0	47	-1.0	-انه	017-	١١٥ -	-1.0	-10	21/-	1,0	0'1-	011	-1.0	ار <u>ه</u>	-4.0	-1.0	-0 BS	~ાળ		
Che			_			8.8		- 10 C		1	ğ	70,	35.	321	724	320	 -	37	235	326	327	376	324	326	321	324	MORETICA	:
1			-729	.{÷	R	. Hg) 2	_	A DE	_		1		240	062	167	290			 	\Box	162	240	25	290	293			•
] ,	1-93	5.63	4-513	537	rature	ssure (in		A die	_	2	19	×	25	100	8		Т				Γ	3	á	0,2	18		12.520151	
1820-1	9-66 6	y g	å	ă	Ambient Temperature Sto	Barometric Pressure (in. Hg) 28 · B4		Samp- ling	c	2	20	4.5	97	25	30	20/	<u> </u>	735	52		180	561	218	226	2.40	\$52	MCCCC FUT 9 (see also 15/025-2.FUT)	
10.2.56 P. 2.56 P. 0.41 Att. 1.55	1	Location	S S	Operator	Ambie	Barom		Cock	ا ا	200	4 4	9	100	020	0,4	\$	10,00	02.4/	10%	1100	5/1	2	\X.	202,	12.5	2,2	Picces Pt	
] Zavat					1000	2775	່ ຍ																					

Chester Environmental Dilution Sampling Data Sheet Rattelle/DOF—Coal Creek

יו ככש	Filter IDs: 8×10	HEST	Impactor 1 5	2 6	3	80	
Dattelle/DOD-Coal Order		Pitot Coeff.	Meter Box AH@	Nozzle Diameter (in.)	Dilution Ratio	Static Pressure (in. H,O)	
	5000	Carion	Run Number 14 - CR- 729	Operator	Ambien Temperature	Barometric Pressure (in He)	- Carrier 1 - Carr

Diluant	p. Press.	15.5	115.5	15,5	18.1	15,5	15.5	7 15.5	15.1	15.8	レジ	┪	╅╾┪	+	+				
	Temp.	गु	6	6	9	925	92	192	5	93	_	193	_ 1 ~ 1	_ 1 • 1	_1 ~ 1 1 1	के के के क	00000	00000	50000
	Meter Reading	184,7	196.3	208,3	8'612	237.0	243.0	1,452	266.9	276.9	7.000	- 23	6'66'8	312,2	2.5 29 99 2.5 312,2	312.2 312.2 323.4 334.1	312,2 312,2 323,1 334,1	312.7 312.7 3.34.1 3.34.1	312,2 334,1 334,1 377,1
Meter Box	Vsc. (in. Hg)	5'2	2.5	2,5	2'2	2.5	2.2	2.5	2.5	2,5	7.		1. 1	1. 1 1	1. 1 11 1				
Met	Temp.	51	115	7	15	715	뇓	<u>=</u>	911	<u>و</u> =	1	2	2 2	375	3755	百二二元	57557	5 5 5 5 5	87557
	ΔH (ln. H ₂ O)	857	1.50	4.50	1,58	7.58	7.58	1.58	1.50	1.58	1	4.50	1.50	1.56	1.58	1.56	55.55	15.50 15.50	25 55 55 55 55 55 55 55 55 55 55 55 55 5
Orifice	Press. Drop (in. H ₂ 0)	12:0	6.41	0.41	0,41	0.41	0.41	0,41	0141	D: 41		, Z	6.41	17.00	0,41	6.41 6.41 6.41	0.41	0.41	0.41
ō	Vacuum (in. H ₂ O)	11-	11	11-	11-),-	- 1(111	-11-	-11		~	7 7	777	7 7 7 7	7 7 7 7 7	7 7 7 7 7 7	7 7 7 7 7 7	7 7 7 7 7 7
per	dill.	101	101	lon	101	83)	101	091	20.	70)	ľ	おし	10 C	10 L	101 101 101	101 101 101 100	101 101 100 100 100	100 100 100 100 100 100 100 100 100 100	100 100 100 100 100 100 100 100 100 100
Chamber	Press. (in. H ₂ O)	2.56	25.5	25.2	4.56	25.2	25.5	35.2	2.56	25.2		2.36	95,2	2.56	2.56 2.56 2.56 2.58	2.56 2.56 2.56 2.58 2.58	2.56 2.56 2.56 2.56 2.56 2.56	2.56 2.56 2.56 2.56 2.56 2.56 2.56	2,36 2,56 2,56 2,56 2,56 2,56
191	Press. Press. Press. (in. H ₂ O) (in. H ₂ O)	1:05	1105	1:03	1.05	50.1	<u>ب</u>	1.05	(105	1.05		1,03	1.03	1.05	1.05	1.05	1.05	1.05 1.05 1.05 1.05	1.05
	Static Press. (in. H ₂ O)	-1.0	0.1-	-1.0	611-	01/	0,1	747	-1.0	5.1-		617	- 1.0	1 1 1	יויוויו	^	^ 1 1 1 1 1 1 1	11 11 11 11 11 11 11 11	1 14 14 14 14 14 14 14 14 14 14 14 14 14
	Page Temp	325	326	, ,	325	225		20.5	327	326	1	12.7	ſ ſ	L I I	f f f l				
	Stack Fig.		287	Ĺ	230 325	250		289		296		7.89	181	287	167 881 782 887	762 783 787 788 788 787 788		787 767 787 787 787 787	288 291 291 291 288 291 291
	A Life Co	82	23	8	2	30		X	138	87	٠		25.55						
	Samp- ling Time		7.85	300	2,5	3,70	34.5	5	2 %	2		200	02h 50h	28 02h 28 02h 28 50h	1 1 1	1 1 1 1 1 1		11	11
	Clock	7.4.7	an/	_	19.00	525	5.	1415	1050	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		1380	S151	5151 5151	5151 5151 5851 5851	5151 5151 5851 5451			

D-155

7	Coal Creek Run	No. W-58-730		Date	7-30	-93
٠	Use defaults as	required for presampling	; setup.	Operator		
7	Obtain by	Parameter	Value	Unit	Nomen.	Default
ſ	Calibration:	Probe Coeff. A	6.3425		Ap	See probe
1		Probe Coeff. B	1.8168	-	D	calibration summary
}		Probe Cal. Temp.	68	°F	T _{cal.p}	68
7		Probe Cal. Press.	29,92	in. Hg	P _{cal.p}	29.92
j		Orifice Coeff. A	0,0018	-	A _o	0.0018
1		Orifice Coeff. B	1.9897	_	B _o	1.9897
J	YPRO02: 0,9832	Orifice Cal. Temp.	68	°F	T _{cal.o}	68
1		Orifice Cal. Press.	29,97	in. Hg	P _{cal.o}	29.92
}	PROTO2 - 0, 4832	_ Meter Box ΔH@	1,734	in. H ₂ O	ΔH@	1.7
3		Pitot Coeff.	०.६५	-	$C_{\mathbf{p}}$	0.84
}	Measure:	Ambient Temp.	75	°F	T_a	90
		Barometer	28.93	in. Hg	$P_{\mathbf{b}}$	29.92
		Stack Temp.	787	°F	T_s	220
•		Static Press.	- 1,05	in. H ₂ O	P_s	-1.5
		Velocity Press.	La .	in. H ₂ O	VΡ	1.8
,		Stack Moist.	9	% vol	H ₂ O	17.3
]		Chamber Temp.	95	°F	T_{C}	90
3		Orifice Vacuum	-11	in. H ₂ O	V_{o}	~15
}		Meter Box Temp.	105	°F	T _{dgm}	100
)	Specification:	Dilution Ratio	30	<u> </u>	DR	30
}		Nozzle Diameter	0.178	in.	đ	0.178
J		Impactor Rate	0.75	acfm	Q_i	0.75
}	Calculation:	Stack Velocity	4246	ft/min	\mathbf{v}_{s}	
]		Probe Flow	0.7336	acfm	Q _{act.}	
ì		Probe Flow	0.5001	scfm	Q _{std.}	
j		Chamber Press.	2,6689	in. H ₂ O	$P_{\mathbf{C}}$	
1		Orifice Flow	16.7293	acfm	Q_{oa}	
		Orifice Flow	14.8250	scfm	Q_{os}	
,		Orifice Press. Drop	014294	in. H ₂ O	P_{O}	
	OUTTOR FOR Jane - in-	Meter Box ΔH 92C042.F01, 181025-2.F01)	[1228	∫in. H ₂ O	ΔH	
,		SDS LEAK RI	m= m.C	745		CHESTER
}	ł.	SDS LEAR 121 DATE:	7-2	5.93	VAC .	5"hb
		CAT, 5				

(RATE & VAC) Resident Constitution Press. (psig) 7 _ 7 Dilunnt N-SB-MM5-730 <u>c</u> 12 \subseteq Ping. 8 63 8 36 MW = 30.56 8 28 8 8 40.7 & ₹ 83 8 83 82 8 a 83 ϖ てなると 46515 47 ø **~** 00 2.0 453.2 מיונ'ו 7657 535.7 577.5 346.031 31514 3144 Vac. Meter (in. Hg) Reading 32018 3821 464.4 393.1 5.55.3 359.3 513.1 428.7 2,0 2.0 20 0,2 . Š 200 9 2.0 Ş Q)? 2,0 219 **6** 2.0 2,5 2'9 20 Meter Box Chester Environmental Dilution Sampling Data Sheet Battelle/DOE—Coal Creek 7. 140=8.47 117 7.7 Fig. <u>-</u>-110 100 7: 2 6 70/ 100 9 7 3 9 202 ナニ Impactor Filter IDs: | 8×10 1160 HEST 09: Š 1.60 2002 1,60 9 Ì ΔH (in. H₂O) 1.60 160 3 3 3 1,56 160 3 160 3 Se 1.60 1.60 Vacuum Press. Drop in. H₂O) (in. H₂O) 64.0 57:0 から 6.43 のよう 0, 13 0.43 の、イン o i Q 643 6270 6.43 6,43 6.43 6.43 5.5 0.43 67.0 Orifice -1.05 (in. H₂O) Nozzle Diameter (in.) O. 128 7 1 ĭ 7 <u>,</u> = = 7 1 = Ŧ ĩ 1 -- テ **>** Ť 7 Meter Box AHW /, 234 0.84 Static Pressure (in. H₂O) 4 26 26 (in. H₂O) (in. H₂O) (in. H₂O) (*F) 5 4 4 25 3 4 20 23 25 भ 45 43 7 ε ₹ Chamber 2167 5.6. 7,67 2.67 261 2,67 2:57 ŝ 267 792 いら 2167 267 2:67 2.67 5.2 25. 167 Dilution Ratio Pitot Coeff. 를 **함** Ξ <u>`</u> _ Ξ -1.05 100 201 -(105 -1.05 105 -1.05 - GB 100 - 05 -1.05 100 13 5971~ レット 701-Static Press. 7.03 元 Barometric Pressure (in. Hg) 28, 93 728 327 326 72.4 220 34 र 228 882 Ambient Temperature Cart 75 Probe Temp. 321 204 3.2 725 327 287 336 125 202 324 Ē Run Number / 1-50-72 3,3 390 288 285 Stack Temp. (*F) 784 140 302 沪 787 289 280 280 ±82 74 104 181 7.30-53 12 25 ئار 7 76 2 7 4 75 ۲ 7 u 12/2/2/17 9 16 22/76 200 1881 210 Samp. ling Time 75 9 `∽ 100 166 B 72 Ë 05 3 7 O 3 Operator Clock 1030 23 Date Z 848 939 S S ₹ 8 SK) इ ž ž 3 P. = 2.67 PARCHETS

10.

0.005

Post-Test PRE-TEST

IMPAGOR LEAK CHECK !

3C028.P02 9 (see abe 141025-2.F02)

/NOTE

24.1.56

Chester Environmental Dilution Sampling Data Sheet Battelle/DOE—Coal Creek

]

Filter Static Pressure (in. H2O) Nozzle Diameter (in.) Meter Box AH® Dilution Ratio Pitot Coeff. Barometric Pressure (in. Hg) Run Number /V - SB Location of SB Ambient Temperature Operator Date

		5	9	7	8
1		-	7	8	4
IDs: 8×10	HEST	Impactor			
r IDs:			•		

					1	3	Chamber	ž	Ö	Orifice		Mete	Meter Box		ī	Diluant
Clock	Ling Time	Temp.	Fig.	Temp.	Press. (in. H,O)	Press. Press. Press. (in. H ₂ O) (in. H ₂ O)	Press. (in. H ₂ O)	E C	Vacuum (in. H ₂ O)	Press. Drop (in. H ₂ O)	ΔΗ (in. H ₂ O)	Temp.	Vac. (in. Hg)	Meter Reading	78mp. (•F)	Press. (psig)
1366	270	11		324	-1.05) '`	2.67	26	11-	6143	1160	न।।	212	500.7	28	17
2 6	285	78	35	374	00'1-	3	2.67	36	1)	52,0	1.60	117	2.0	571.3	82	7
۱ -	200)	94	289 74]	2017	2	2.57	41	71	6,43	1,60	115	2.0	883.3	Š	C.
22 25	T —	18	188 227	1	-1.05	1.1	12.67	16	11-	0,43	1,60	315	2.2	595,7	12	2
2 2	27.5	12	287	25	-1.05		2.67	16	11-	6.43	1.60	115	2,0	2,009	50	5
		77	35	324	-1,05	==	44.7	46	11	643	1.60	115	2.0	1.613	82	5
200		-	283	328	-1.05	2	2,67	- 5	-1í	6.43	1,60	115	20	6 30, 4	82	12
3	200	1	184 227	22.	-1.05	13	2,67	16	11-	0.43	1.60	115	20	0.570	Ğ	17
8	840		यर प्र	37.5	1.3	3,5	1.6.7	76	11-	30	1.60	15	23	1,52,7	18	2
136	~	9	3 32	33.	-1.05	13	19.2	ժե	-11	6.43	7.00	15	3	663,1	8	2
1 to 2	2 2				-1:05	1.1	1.97	26	11-	0.43	2,60	15	3	674.4	82	7
3 5		7.	沒	327	70.1	7 '1	2.67	25	11-	٥, ١	١١٥٥	115	2.00	685.5 BZ	28	12
1,00	0%	25	287	376	1.05)-1	2:00	16	11-	22.0	1.60	115	2.0	6969	Š	17
1615	37/6	1		328	1,05	1:1	7267	ð	=-	0.43	1,60	3	0'2	70 9 .Y	18	7
1,1,1	780			227	50-1-	111	2.67	91	11	0.43	637	115	2.0	125,480	9	2
		-														
COZE. FO	93C028.F02 9 (see also (\$1025-2.F02)	181025.2.	ş												Ĩ	Revised 06/16/93

3	Coal Creek Run	No. N-513-731		Date	7-3,	- 97
J		required for presampling	z setup.	Operator		um
ì	Obtain by	Parameter	Value	Unit	Nomen.	
ļ	Calibration:	Probe Coeff. A	6.3425	_	A _p	See probe
,		Probe Coeff. B	1, 9168]-	В _р	calibration summary
		Probe Cal. Temp.	68	°F	T _{cal.p}	68
1		Probe Cal. Press.	29,92	in. Hg	P _{cal.p}	29.92
j		Orifice Coeff. A	0:0018]~	Ao	0.0018
1		Orifice Coeff. B	119897]	B _o	1.9897
j	Box 5	Orifice Cal. Temp.	હિસ] °F	T _{cal.o}	68
}		Orifice Cal. Press.	24,92	in. Hg	P _{cal.o}	29.92
- }	YPACON: 0.9832	Meter Box ΔH@	l.734ู	in. H ₂ O	ΔH@	1.7
,		Pitot Coeff.	0.84]-	C _p	0.84
	Measure:	Ambient Temp.	77] ° F	Ta	90
_		Barometer	29.02	in. Hg	P_{b}	29.92
		Stack Temp.	284	° F	T_s	220
•		Static Press.	-1.0	in. H ₂ O	P_s	-1.5
}		Velocity Press.	1,05	in. H ₂ O	VP	1.8
,		Stack Moist.	9	% vol	H ₂ O	17.3
1		Chamber Temp.	85]•F	T _C	90
,		Orifice Vacuum	-11	in. H ₂ O	\mathbf{v}_{o}	-15
1		Meter Box Temp.	95	₹°F	T _{dgm}	100
j	Specification:	Dilution Ratio	30]_	DR	30
1		Nozzle Diameter	0.178	in.	đ	0.178
1		Impactor Rate	0.75	acfm	Q_{i}	0.75
1	Calculation:	Stack Velocity	4133	ft/min	V_s	
J		Probe Flow	017143	acfm	Q _{act}	
1		Probe Flow	P0 Pr. 0	scfm	Q _{std.}	
		Chamber Press.	2.5567	in. H ₂ O	P_{C}	
		Orifice Flow	15:8763	acfm	Q_{oa}	
1		Orifice Flow	14,5026	scfm	Q_{os}	
		Orifice Press. Drop	0:3987	in. H ₂ O	P_{O}	
		Meter Box ΔH	11620	in. H ₂ O	ΔН	
1	Revised 06/16/93	920042.1901, 181025-2.1901) SDS LEAK RA	sr=: 0.0	45		CHESTER
]	r	DATE:	• • • • • • • • • • • • • • • • • • • •	25.98	VAC	54

Po = 2,57 Po = 0.40 OH = 1,62

3%

MW = 30.50 IV-SB-MUM-73 ø 76 His = 9.4 Chester Environmental Dilution Sampling Data Sheet ~ Impactor HEST Filter IDs: 8×10 Battelle/DOE-Coal Creek 0 Nozzle Diameter (in.) O 178 Meter Box AH@ 1,7'3' 0.81 Static Pressure (In. H2O) Dilution Ratio Pitot Coeff. 20.62 Barometric Pressure (in. Hg) -31-93 Run Number N-5 B 255 Ambient Temperature Operator Location Date

17.5 2,5 Press. (psig) 7.5 13 7: Diluant apper Service Control ã ē 33 ã ß 82 60 co 8 B ã $\widetilde{\mathbf{x}}$ 8 727.758 7347 785.7 809.4 774.4 833.0 Vac. | Meter (in. Hg)| Reading F . 128 845.0 87.78 1517 763. 8801 197 5,5 2.5 2.3 5.2 23 512 パド 5 べて 7,7 Meter Box E E 102 5 9 5 5 <u>.</u> 2 5 <u>0</u> 4 2 <u>\$</u> 202 791 ΔH (in. H₂O) 162 191 100 101 797 مر ت 164 . 61 <u>ر</u> ا 9 ? Vacuum Press. Drop in. H₂O) (in. H₂O) 20 Jeans. T. 0 ₩ **MON ₽**q√ 100 200 TO S 10 A Hote אסת 400 なって Orifice (in. H₂O) cH. = ĩ 7 = = こ 7 ~ Ŧ = Press. | Press. | Press. | Temp (in. H₂O) (in. H₂O) (in. H₂O) (in. H₂O) (*F) 8 2156 Rb 2.56 86 161 89 3 0 2.56 90 90 Š 9 6 5 Chamber スパ 2:36 2:25 から 2,72 252 2,576 21.52 77 252 . Š 1.05 (105) ام الم 1.05 -co 1.05 503 50 1005 1.05 Š Š 100 7:0 1-0. 2 <u>0</u> -1.0 Static Press. 10 Q-1 2 0 211-Probe Temp. 325 321 324 762 282 255 | 324 283 326 3,78 224 282 299 327 287 287 Stack Temp. (*F) 787 186 28.5 122 286 788 787 181 A day 75 3 47 7 76 7 99 76 B Samp-ling Time 2 Ē 3 Š 5 Ñ × z Z Clock S45 ĝ 3 क्र ~ 3 ž 95

(RATE + VAC) Amind OSVISM

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PRG-TEST POST-TEST

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D-160

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Chester Environmental Dilution Sampling Data Sheet
Raffelle/DOF—Coal Creek

								,														
							Diluant	Press.	(psig)	9 2 2	12.0	40	12.0	12.0	5.7	120	1210	120	12.0	400	4	1200
							ă	Temp.		à	85/	87	88	90	õ	91	26	26	26	92	26	4
			\$	9	7	80			Reading	939.3	38.1	463,1	0.579	986.8	998.7	5,010	27.72	23.9	48.6	56.5	1 ,83	8/1
							Meter Box	Vac.	(in Hg)	2.5	2.5	2,5	2.5		5.2	2,5	312	Z	2,52	215	2,4	212
				7	m	4	Mere	Temp.	_	2	017	017	91	ા	110	110	2	2	110	011	1.0	110
	8×10	HEST	Impactor						H ₂ O)	1164	140.4	Old Cont	1,60	1,60	3,	1160	(160	1160	140	160	1.60	د د ٽ
Battelle/DOE—Coal Creek	Filter IDs:						Orifice	Vacuum Press. Drop	(in. H ₂ O)	370	0.40	0.41	14.0.	0,40	0.47	14.0	1410	11-19	15.0	0.41	9,41	F S
-Coal	•						ع ا	Vacuum	(fa. H ₂ O)	71	-	11-	11-	-11	11~))-	11-	3)1-	-11	-11	Ī
00 E				(ia)		1. H ₂ O)		S Constant	E.	90	Lb	96	86	97	47	96	96	8	26	8	96	8
ttelle/l		oeff.	Meter Box AH@	Nozzle Diameter (in.)	Dilution Ratio	Static Pressure (in. H ₂ O)	į	Press.	(in. H ₂ O)	95'2	2.56	25.5		Т	l	2,56	2022		2.2	2.56	20,2	2.50
Ba		Pitot Coeff	Meter	Nozzle	Dilutio	Static 1		Press.	(in. H ₂ O) (in. H ₂ O) (in. H ₂ O)	3011	1.05	1,05	1.05	so'	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	76.1	1.05	3	١٠٩٧	Ţ.	1.05	105
		Ţ-	Ť	Γ-	<u> </u>	\Box		Static Press.	(in. H ₂ O)	0'1-	-1,0	710	e, -	21	Q T	01-	017-	4.0	0.1-	0,10	ا نم	077
			3,						(F)	328	222	227	224	207	1	23.4	317	27.60	31%	32.5	226	274
			12-73			n. Hg)		Stack Temp.	E.		283	7.2	283	785	208	787),×	187	127		
			XX)	erature	Barometric Pressure (in. Hg)		Amb.	E	83	ğ	200 GS	3	96,	9	T		Car	90	8	86	60
		9	Run Number	Jo	Ambient Temperature	etric Pre			i i	27.5	180	3,00	1	22,5	* * * * * * * * * * * * * * * * * * * *	22	2 2 2	4 %		3 .	227	1
	236	Location	R. R.	Operator	Ambie	Barom		امران	i i	۲	5	١	2	14.05	2 2 2	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	1.22		1	ž	13.70	Š

99C021.F02 9 (see also 181005-1.F04)

Revised D6/16/93

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9.59 7.5 011 001

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D-11: High-Volume Sampler (Soot Blowing Particulate Sampling)

Page of	0,		Pip Pipt		Continuents																2 PO	2		Difference				1	4	TI ACCOUNT OF THE
— (HOT BOX NO.	COLD BOX NO	PROBE NO.	STACK DIA	Hot Box	. E																		Pairie Pairie					1	_
				110	Impieger	(CCFF)																								
	NOI	No		No.	Profe	Terre. (*F)										. •					, ,		Impiager	Contents		•				
SHEET	ORIFICE CORRECTION	METER CORRECTION	CALIBRATION DATE	CONTROL BOX NO.	Spack	100.	212	562	243	240	240	187	290	285	290	290	2/2/2/2	240	Ê	-	2000		Ē	S				-		
STACK SAMPLING DATA SHEET	ORIFICE	METER C	CALIBRA	CONTRO	Vacous	(ja. Hg)															10,00		Inspinger	Š	<u>-</u>	7	-	•		
LING			872	1	aperature	\$ E	120	170	187	205	205	205	205	200	200	200	202	200	202		Commenced									
SAMP	193	LTL-5/1		3. H	Mater Ten	4 E	1	l	{	-	(-						l		197 101			Negative	73.5	7.4.1	7			
STACE	re 7/27,	(- 5a·)	81ZE,0 /	223	ᄪ	Ad. (b. H20)															0000		AK CHECK	Positive	1 35	7.2	-			
	TEST DAT		NOZZLE (STATIC PRESSURI	ő	Perf d	052	050	850.	0,00	090	270	.060	090.	.060	. 060	,060	070'	090		fm: Shed		PITOT LEA		Before	A Sec		ğ	8 8	,
	•			46	Picol A P	(je 1820)	145	-			-								_		26cm					, j	varae	-		
	¥	ation 54	30028	~ ~	112	Mater Reading		1	1	1		1	1		1	1		١	1		Note: Son		SCK SCK	DOM Res	(cfm)	N. A. Cares part	=0 0 507 Variae			
	BATTELLE	T 600	NO. 4	CONTROL BOX OPERATO	TIME THE		01.30	25.00	0550	0090	3	0/2/0	0630	00,90	0650	0000	0110	0210	0730	+			LEAK CHECK	Vacue	Ge Heb					
	THE I	TEST UN	PROJECT	CONTRO	BAROME	2																	CYSTEN			1	Aber			

	_			4												}								v v	%									TONE	
	Page 1 of	Ģ.	ļ	. 47.1, pitet	, ,		Comment										.]	·						MW= 28.5	%H20- 9								7	KEYSTO	ן רו
		HOT BOX NO.	COLD BOX NO	PROBE NO. 4	FILTER NO	STACK DIA	Hot Box	1	1			_															•] \	Y !	ل
					, 84		Japan	i Ç	\-	_				_								-					i								
		PION	NON .	TE	NO.		Probe	įe	1													-			-			feetb		-					
	HEET	CORRECT	ORRECT	TION DA	KRECTK	L BOX N	Sect	įe	290	291	141	262	200	284	290	270	<i>981</i>	180	242	290	29.1	289	120	252	210	21/12	Ī	3							
	ATA S	ORIFICE CORRECTION	METER CORRECTION	CALIBRA	PITOT CORRECTION	CONTROL BOX NO	Vacuum	3												-		~-				-	- Indian	2	-	7	ei	-	•		
	STACK SAMPLING DATA SHEET	-	7	ditions			abereliure.	9 E	/50	185	193	200	200	204	202	402	502	205	205	205	205	205	205	205	205	602/500	İ	_			1		_		
•	SAMP	193	N-5A-HV5-727	Star C	12	A	Meer To	. (£	J-									,										Negative.	13.5	13.7	٦,				
٤.	STACE	E 7/27/93	N-5A-	NZE.A	PRESSURE	HRECTION	Deifice A.H.	Ad.	80.	20.0	20,	760	20.	10%	,036	2,03	200	4801	30,	160'	20'	960'	160'	260	20.	20/20	EAK CHECK	Positive	13.3	13.2	-				
,872.	\	TEST DATE	TEST NO.	NOZZLE (SIZE, A)	STATIC PR	PORT DIRE	Orig	Reg d.	"Sch																		PITOT LEA		Before	After	- - - -	S S	8	ZV	
		Ļ		•	120	*	Pitot a P	(00, 11)	-	_						-											' 								
		uk	No how 5A	20024	CONTROL BOX OPERATOR IV	BAROMETRIC PRESSURE 28.	Dry Qu	Meter Reading	1																		ECK.	DOM Pare	(clm)						
		BATTELLE		ė ON.	L BOX O	TRIC PRI	Tibes		127 0	., -	20	2	a,	5	42760	10	8	000	8	110	152110	જ	ohi	32	03)	170/180	LEAK CHECK	Vacuum	(F. HC.						
•		CHENT	TEST UNIT	PROJECT NO	CONTRO	BAROME		1																			SYSTEM			Before	Aber				AQE 1/92

N-5A-HVS-729-1 (Soot Blaw)

Column C						STAC	K SAMI	PLING	STACK SAMPLING DATA SHEET	HEET				Page (of /
The color Test	CLIENT		TK CF		TEST DAT		Mb-47.		ORIFICE	CORRECT	NOI		HOT BOX	NO.
State Part Columbia Part Part Part Columbia Part Part Columbia Part Pa	TEST U	LN	- 3 A		TEST NO.	7-11	g H		METER C	ORRECTI	NO.		COLD BO	9 2 2
S. D. A. FORT DIRECTION	PROJEC	ON TO	300 28 100 P A TOP	4	STATIC P	RESSINE	100		PITOT CO	RECTIO			FILTER N	0
Time	BARON	IETRIC PR	ESSURE 28	100	PORT DIR	ECTION			CONTRO	BOX NO			STACK DI	A.
Materia (action) Final Materia (action) Final Materia (action) Final Materia (action) Final Materia (action) Final Materia (action) Final Materia (action) Final Materia (action) Final Materia (action) Final F	Trevene	Time	Dry Que	Pitot & P	5	fice A H	Mater T.	Importature	Vacuum	Stack	Probe	Impinger	Hot Box	Comme
1	įį		Mater Reading	(b. H2O)	ゖ゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙゙	Ad. (b. H20)	4 E	\$ E	(je. Hg)	įE		Tone.	ř.	
1	Sistarc		,	3	0,0375	0.0375	40			286				13 Table 50
1,1	Petial	_			0.0375	0.0375	_			287				S2001 14.0
1, 1 1, 1 1, 20 2, 29		52,16		=	\					288				
150 291 150 297 297 297 297 297 297 298 297 298 297 298		7640		=			85)			88.2	İ			
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1		21.60		-			153			187				
170 170 298 290 298 290 298 290 298 290		2 2		=			591			981				
1,1 V 175 290		27.50		=			170			288				
Column C		200		-	,	>	311			290				
LEAK CHECK		200									. <i>*</i> 			
CO2 CO3														
LEAK CHECK														
LEAK CHECK														
LEAK CHECK														•
LEAK CHECK														Estimates:
LEAK CHECK												,		MW-
LEAK CHECK														XH20-
Vacanum DGM Pass (in. Hg) (cfine) Abort CO2 CO2 CO3 CO3 CO3 CO3 CO3 CO3														
Vacanta DCAM Rate Protérire Negative No. Contents Frank Jatus (in. Hg) (efine) After 1 2 3 . </td <td>SYSTEM</td> <td></td> <td>BCK</td> <td> </td> <td></td> <td>K CHECK</td> <td></td> <td>_</td> <td></td> <td></td> <td>Į.</td> <td>i</td> <td>•</td> <td>ļ</td>	SYSTEM		BCK			K CHECK		_			Į.	i	•	ļ
(ia. Hg) (cfm) Padors 1. 2. 3. 4. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.		Vacan	DOM Rate			Positive	Negative	_	2	3			4	Develope
CO2 1 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4		F. Hg)	(c(m)		Before				-			1		-
2 3.	Before			,	Aber				7		•			
\$.	After					-	~	_	-					
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AQE 2/92

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STACK SAMPLING DATA SHEET	ORIFICE CORRECTION	METER CORRECTION	CALIBRATION DATE	PITOT CORRECTION	2		(in. Hg)	-																		Inpinger	Š.	l.	2.	3.	4.	~	obe pre	starting testing
TING		1-2					E)	145	155	165	165	165	165	165	165	57)	165	165	571	57]								•					<u>ه</u> *	
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	TEST DATE	TEST NO.	NOZZLE (SI	STATIC PRESSURE	- WA		(s. H20)	-			-									-						PITOT LEAK		Before	After		COZ	20	8	£
		S.A		MEP	3	1	(is. H20)		1.1	1:,	1	1	1,1	1	1''		1	1		1												-		_
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	CLIENT BATTELLE	IT Boil	T NO. 42	CONTROL BOX OPERATOR	EI KIC LIKI	į		5421	1,300	1315	1330	1345	1400	1415	1430	7447	1500	1515	1530	ジネン						LEAK CHECK	Vectore	. E						
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D-12: Flue Gas Sampling Calculation Spreadsheets

Т	UN NO. EST DATE AMPLING TIME, 24 HOUR CLOCK FROM TO	1 7/26 1417 2017	2 7/27 1120 2013	1020
DN	SAMPLING NOZZLE DIAMETER, IN.	0.247	0.182	0.182
TT	NET TIME OF TEST, MIN.	360	360	360
PB	BAROMETRIC PRESSURE, IN. HG	28.84	28.82	28.84
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	2.00	0.80	0.80
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	249.6	167.6	174.1
TM	AVG. GAS METER TEMPERATURE, F	95	92	90
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	214.4	144.2	150.4
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	449.0	550.0	458.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF	19.7	24.2	20.1
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	8.43	14.37	11.81
MD	MOLECULAR FRACTION OF DRY GAS	0.92	0.86	0.88
CO2	STACK GAS CO2, VOL PERCENT DRY	14.5	14.5	12.0
02	STACK GAS 02, VOL PERCENT DRY	4.0	4.1	4.4
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N 2	STACK GAS N2, VOL PERCENT DRY	81.5	81.4	83.6
EA	STACK GAS EXCESS AIR, PERCENT	22.8	23.6	24.9
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.5	30.5	30.1
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.4	28.7	28.7
CP	PITOT TUBE COEFFICIENT	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F	310	301	282
NP	NET SAMPLING POINTS	24	26	25

	RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK FROM TO	1 7/26 1417 2017	2 7/27 1120 2013	3 7/28 1020 1731
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	0.05	0.05	0.05
PS	STACK GAS ABS. PRESSURE, IN. HG	28.89	28.87	28.89
vs	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3518	3803	3823
AS	STACK AREA, SQ. IN.	16277.	16277.	16277.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	224732	229670	243876
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	397626	429836	432141
I	ISOKINETIC RATE, PERCENT	90.0	109.1	107.2
MF	PARTICULATE MASSPROBE, CYCLONE, AND FILTER, MG	0.0	8597.0	0.0
CAN	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT STACK 02, GR/NCF (DRY)	0.000	0.918	0.000
CAT	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT STACK 02, GR/ACF (WET)	0.000	0.491	0.000
CAN3	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.000	0.979	0.000
CAT3	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.000	0.523	0.000
CAW	PARTICULATE EMISSIONSPROBE, CYCLONE AND FILTER, LB/HR	0.00	1807.70	0.00

RUN NO. TEST DATE	1 7/26	2 7/27	3 7/28
VOLUME OF GAS SAMPLED, NCF (DRY)	214.4	144.2	150.4
MOISTURE FRACTION VOLUME, PERCENT	8.4	14.4	11.8
AVERAGE STACK TEMPERATURE, F	310	301	282
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	224732	229670	243876
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	397626	429836	432141
ISOKINETIC RATE, PERCENT	90.0	109.1	107.2
EXCESS AIR, PERCENT	22.8	23.6	24.9
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	8597.0	0.0
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.000	0.918	0.000
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.000	0.491	0.000
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.000	0.979	0.000
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.000	0.523	0.000
PARTICULATE EMISSIONS, LB/HR	0.0	1807.7	0.0

RUN NO. TEST DATE	1 7/26	2 7/27	3 7/28
VOLUME OF GAS SAMPLED, NCM	6.07	4.08	4.26
MOISTURE FRACTION VOLUME, PERCENT	8.4	14.4	11.8
AVERAGE STACK TEMPERATURE, C	154	149	138
STACK VOLUMETRIC FLOW RATE, NCMM	6363	6503	6905
STACK VOLUMETRIC FLOW RATE, CMM	11259	12171	12236
ISOKINETIC RATE, PERCENT	90.0	109.1	107.2
EXCESS AIR, PERCENT	22.8	23.6	24.9
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	8597.0	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	2101.7	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	1122.9	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	2239.3	0.0
PARTICULATE LOADING, MG/CM AT 3% 02 (WET)	0.0	1196.4	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	820.0	0.0

7	RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK FROM TO	4 7/29 926 1525	5 7/30 915 1530	900
DN	SAMPLING NOZZLE DIAMETER, IN.	0.182	0.182	0.182
TT	NET TIME OF TEST, MIN.	360	360	360
PB	BAROMETRIC PRESSURE, IN. HG	28.76	28.77	28.92
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	0.80	0.80	1.00
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	165.0	159.8	171.8
TM	AVG. GAS METER TEMPERATURE, F	82	66	80
VMSTD		144.2	144.0	151.7
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	458.0	336.0	297.0
VWGAS	VOLUME OF H20 VAPOR COLLECTED, NCF	20.1	14.8	13.1
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	12.25	9.30	7.93
MD	MOLECULAR FRACTION OF DRY GAS	0.88	0.91	0.92
CO2	STACK GAS C02, VOL PERCENT DRY	14.8	14.7	14.4
02	STACK GAS 02, VOL PERCENT DRY	4.0	4.1	4.4
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.2	81.2	81.2
EA	STACK GAS EXCESS AIR, PERCENT	22.9	23.6	25.8
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.5	30.5	30.5
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.0	29.4	29.5
CP	PITOT TUBE COEFFICIENT	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE, F	292	296	282
NP	NET SAMPLING POINTS	24	24	25

	RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK FROM TO	4 7/29 926 1525	5 7/30 915 1530	6 7/31 900 1517
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	0.05	0.05	0.05
PS	STACK GAS ABS. PRESSURE, IN. HG	28.81	28.82	28.97
vs	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3635	3645	3764
AS	STACK AREA, SQ. IN.	16277.	16277.	16277.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	227230	234272	251373
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	410867	412009	425425
I	ISOKINETIC RATE, PERCENT	110.3	106.8	104.9
MF	PARTICULATE MASSPROBE, CYCLONE, AND FILTER, MG	9980.1	0.0	6273.8
CAN	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT STACK O2, GR/NCF (DRY)	1.066	0.000	0.637
CAT	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT STACK O2, GR/ACF (WET)	0.589	0.000	0.376
CAN3	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	1.129	0.000	0.691
CAT3	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0,624	0.000	0.408
CAW	PARTICULATE EMISSIONSPROBE, CYCLONE AND FILTER, LB/HR	2074.99	0.00	1372.17

RUN NO. TEST DATE	4 7/29	5 7/30	6 7/31
OLUME OF GAS SAMPLED, NCF (DRY)	144.2	144.0	151.7
IOISTURE FRACTION VOLUME, PERCENT	12.3	9.3	7.9
VERAGE STACK TEMPERATURE, F	292	296	282
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	227230	234272	251373
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	410867	412009	425425
ISOKINETIC RATE, PERCENT	110.3	106.8	104.9
EXCESS AIR, PERCENT	22.9	23.6	25.8
PARTICULATE MASS - PROBE, CYC, FILTER CATCH			
MG	9980.1	0.0	6273.8
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	1.066	0.000	0.637
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.589	0.000	0.376
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	1.129	0.000	0.691
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.624	0.000	0.408
PARTICULATE EMISSIONS, LB/HR	2075.0	0.0	1372.2

RUN NO. TEST DATE	4 7/29	5 7/30	6 7/31
VOLUME OF GAS SAMPLED, NCM	4.08	4.08	4.30
MOISTURE FRACTION VOLUME, PERCENT	12.3	9.3	7.9
AVERAGE STACK TEMPERATURE, C	144	146	138
STACK VOLUMETRIC FLOW RATE, NCMM	6434	6633	7118
STACK VOLUMETRIC FLOW RATE, CMM	11634	11666	12046
ISOKINETIC RATE, PERCENT	110.3	106.8	104.9
EXCESS AIR, PERCENT	22.9	23.6	25.8
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	9980.1	0.0	6273.8
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	2438.4	0.0	1457.6
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	1348.5	0.0	861.2
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	2582.7	0.0	1581.3
PARTICULATE LOADING, MG/CM AT 3% 02 (WET)	1428.3	0.0	934.3
PARTICULATE EMISSIONS, KG/HR	941.2	0.0	622.4

NILES BOILER, STACK, LOCATION 5A, MULTI-METALS TRAIN

7	RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK FROM TO		2 7/29 900 1529	3 7/31 905 1542
DN	SAMPLING NOZZLE DIAMETER, IN.	0.228	0.228	0.228
TT	NET TIME OF TEST, MIN.	360	360	360
PB	BAROMETRIC PRESSURE, IN. HG	29.00	28.88	29.06
ΡM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.83	1.87	1.81
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	276.2	281.4	277.5
TM	AVG. GAS METER TEMPERATURE, F	107	99	97
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	232.0	238.9	237.9
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	536.4	564.7	559.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF	23.6	24.8	24.6
M	MOISTURE IN STACK GAS BY VOLUME, PERCENT	9.23	9.41	9.36
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.91	0.91
CO2	STACK GAS CO2, VOL PERCENT DRY	13.0	12.6	12.6
02	STACK GAS 02, VOL PERCENT DRY	6.0	6.5	6.5
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	81.0	80.9	80.9
EA	STACK GAS EXCESS AIR, PERCENT	39.0	43.7	43.7
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.3	30.3	30.3
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.2	29.1	29.1
CP	PITOT TUBE COEFFICIENT	0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F	294	293	291
NP	NET SAMPLING POINTS	4	4	4

NILES BOILER, STACK, LOCATION 5A, MULTI-METALS TRAIN

	RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK FROM TO	1 7/27 954 1619	2 7/29 900 1529	3 7/31 905 1542
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	-0.07	-0.08	-0.08
PS	STACK GAS ABS. PRESSURE, IN. HG	28.93	28.80	28.98
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	4146	4131	4110
AS	STACK AREA, SQ. IN.	13685.	13685.	13685.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	225544	223594	224809
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	393984	392578	390616
I	ISOKINETIC RATE, PERCENT	95.8	99.5	98.5
MF	PARTICULATE MASSPROBE, CYCLONE, AND FILTER, MG	237.6	105.9	186.3
CAN	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT STACK 02, GR/NCF (DRY)	0.016	0.007	0.012
CAT	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT STACK 02, GR/ACF (WET)	0.009	0.004	0.007
CAN3	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.019	0.008	0.015
CAT3	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT 3% 02, GR/ACF (WET)	0.011	0.005	0.009
CAW	PARTICULATE EMISSIONSPROBE, CYCLONE AND FILTER, LB/HR	30.49	13.08	23.23

NILES BOILER, STACK, LOCATION 5A, MULTI-METALS TRAIN

RUN NO. TEST DATE	1 7/27	2 7/29	3 7/31
VOLUME OF GAS SAMPLED, NCF (DRY)	232.0	238.9	237.9
MOISTURE FRACTION VOLUME, PERCENT	9.2	9.4	9.4
AVERAGE STACK TEMPERATURE, F	294	293	291
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	225544	223594	224809
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	393984	392578	390616
ISOKINETIC RATE, PERCENT	95.8	99.5	98.5
EXCESS AIR, PERCENT	39.0	43.7	43.7
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	237.6	105.9	186.3
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.016	0.007	0.012
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.009	0.004	0.007
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.019	0.008	0.015
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.011	0.005	0.009
PARTICULATE EMISSIONS, LB/HR	30.5	13.1	23.2

LES BOILER, STACK, LOCATION 5A, MULTI-METALS TRAIN

RUN NO. TEST DATE	1 7/27	2 7/29	3 7/31
LUME OF GAS SAMPLED, NCM	6.57	6.77	6.74
ISTURE FRACTION VOLUME, PERCENT	9.2	9.4	9.4
'ERAGE STACK TEMPERATURE, C	145	145	143
ACK VOLUMETRIC FLOW RATE, NCMM	6386	6331	6365
TACK VOLUMETRIC FLOW RATE, CMM	11156	11116	11061
SOKINETIC RATE, PERCENT	95.8	99.5	98.5
XCESS AIR, PERCENT	39.0	43.7	43.7
ARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
IG	237.6	105.9	186.3
'ARTICULATE LOADING, 1G/NCM AT STACK O2 (DRY)	36.1	15.6	27.6
PARTICULATE LOADING, MG/CM AT STACK 02 (WET)	20.7	8.9	15.9
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	43.4	19.4	34.3
PARTICULATE LOADING, MG/CM AT 3% 02 (WET)	24.8	11.1	19.7
PARTICULATE EMISSIONS, KG/HR	13.8	5.9	10.5

NILES BOILER, STACK, LOCATION 5A, MODIFIED METHOD 5

•	RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK FROM TO	1 7/26 1200 1835	2 7/28 900 1539	7/30 900
DN	SAMPLING NOZZLE DIAMETER, IN.	0.192	0.192	0.192
TT	NET TIME OF TEST, MIN.	360	360	360
PB	BAROMETRIC PRESSURE, IN. HG	29.00	28.96	28.88
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	0.87	0.89	0.85
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, CF (DRY)	191.9	190.4	190.0
TM	AVG. GAS METER TEMPERATURE, F	122	125	104
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, NCF (DRY)	160.0	157.7	162.8
VW	TOTAL H20 COLLECTED IN IMPINGERS AND SILICA GEL, ML	368.2	356.8	340.8
VWGAS	VOLUME OF H2O VAPOR COLLECTED, NCF	16.2	15.7	15.0
М	MOISTURE IN STACK GAS BY VOLUME, PERCENT	9.19	9.05	8.43
MD	MOLECULAR FRACTION OF DRY GAS	0.91	0.91	0.92
CO2	STACK GAS C02, VOL PERCENT DRY	11.7	12.2	13.0
02	STACK GAS 02, VOL PERCENT DRY	7.5	7.0	6.0
CO	STACK GAS CO, VOL PERCENT DRY	0.0	0.0	0.0
N2	STACK GAS N2, VOL PERCENT DRY	80.8	80.8	81.0
EA	STACK GAS EXCESS AIR, PERCENT	54.2	48.8	39.0
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	30.2	30.2	30.3
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	29.1	29.1	29.3
CP	PITOT TUBE COEFFICIENT	0.84	0.84	0.84
TS	AVG. STACK TEMPERATURE, F	294	292	286
NP	NET SAMPLING POINTS	4	4	4

NILES BOILER, STACK, LOCATION 5A, MODIFIED METHOD 5

	RUN NO. TEST DATE SAMPLING TIME, 24 HOUR CLOCK FROM TO			900
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	-0.74	-0.09	-0.09
PS	STACK GAS ABS. PRESSURE, IN. HG	28.26	28.87	28.79
vs	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	4225	4200	4127
AS	STACK AREA, SQ. IN.	13685.	13685.	13685.
QS	STACK GAS VOLUMETRIC FLOW RATE AT NORMAL CONDITIONS, NCFM (DRY)	224700	229124	227935
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM (WET)	401523	399139	392189
I	ISOKINETIC RATE, PERCENT	93.5	90.4	93.8
MF	PARTICULATE MASSPROBE, CYCLONE, AND FILTER, MG	0.0	0.0	0.0
CAN	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT STACK 02, GR/NCF (DRY)	0.000	0.000	0.000
CAT	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT STACK 02, GR/ACF (WET)	0.000	0.000	0.000
CAN3	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT 3% O2, GR/NCF (DRY)	0.000	0.000	0.000
CAT3	PARTICULATE LOADINGPROBE, CYCLONE, AND FILTER AT 3% O2, GR/ACF (WET)	0.000	0.000	0.000
CAW	PARTICULATE EMISSIONSPROBE, CYCLONE AND FILTER, LB/HR	0.00	0.00	0.00

NILES BOILER, STACK, LOCATION 5A, MODIFIED METHOD 5

RUN NO. TEST DATE	1 7/26	2 7/28	3 7/30
VOLUME OF GAS SAMPLED, NCF (DRY)	160.0	157.7	162.8
MOISTURE FRACTION VOLUME, PERCENT	9.2	9.1	8.4
AVERAGE STACK TEMPERATURE, F	294	292	286
STACK VOLUMETRIC FLOW RATE, NCFM (DRY)	224700	229124	227935
STACK VOLUMETRIC FLOW RATE, ACFM (WET)	401523	399139	392189
ISOKINETIC RATE, PERCENT	93.5	90.4	93.8
EXCESS AIR, PERCENT	54.2	48.8	39.0
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	0.0	0.0
PARTICULATE LOADING, GR/NCF AT STACK O2 (DRY)	0.000	0.000	0.000
PARTICULATE LOADING, GR/ACF AT STACK O2 (WET)	0.000	0.000	0.000
PARTICULATE LOADING, GR/NCF AT 3% O2 (DRY)	0.000	0.000	0.000
PARTICULATE LOADING, GR/ACF AT 3% O2 (WET)	0.000	0.000	0.000
PARTICULATE EMISSIONS, LB/HR	0.0	0.0	0.0

NILES BOILER, STACK, LOCATION 5A, MODIFIED METHOD 5

RUN NO. TEST DATE	1 7/26	2 7/28	3 7/30
VOLUME OF GAS SAMPLED, NCM	4.53	4.47	4.61
MOISTURE FRACTION VOLUME, PERCENT	9.2	9.1	8.4
AVERAGE STACK TEMPERATURE, C	145	144	141
STACK VOLUMETRIC FLOW RATE, NCMM	6362	6488	6454
STACK VOLUMETRIC FLOW RATE, CMM	11369	11302	11105
ISOKINETIC RATE, PERCENT	93.5	90.4	93.8
EXCESS AIR, PERCENT	54.2	48.8	39.0
PARTICULATE MASS - PROBE, CYC, FILTER CATCH,			
MG	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT STACK O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT STACK O2 (WET)	0.0	0.0	0.0
PARTICULATE LOADING, MG/NCM AT 3% O2 (DRY)	0.0	0.0	0.0
PARTICULATE LOADING, MG/CM AT 3% 02 (WET)	0.0	0.0	0.0
PARTICULATE EMISSIONS, KG/HR	0.0	0.0	0.0

APPENDIX E QA/QC

OA/OC

E-1. Sampling Completeness

The goal for data completeness in this study was defined in the QAPP as at least 85 percent. One aspect of achieving this goal is the completeness of sampling activities. Table E-1 shows the percent completeness of sampling of flue gas, solid and liquid streams at Niles Boiler No. 2. Footnotes to the table identify the causes of any incomplete sampling efforts; any such deviations from plan are also discussed in section 3.2.4 of this report.

Table E-1 shows that flue gas sampling was 100 percent complete. This completeness value excludes the PSDS filters from Location 5b, which contained insufficient sample for carbon/radionuclide analyses. However, carbon/radionuclide data in the stack were obtained at the co-located sampling Location 5a. Solid and liquid sample collection was complete.

The ESP ash and air heater ash sample collections are indicated in Table E-1 as 100 percent complete, and that was the case in that all achievable samples were collected. However, in some collection periods samples could not be collected from individual hoppers. These occurrences have been noted as deviations from the sampling plan, in Section 3.2.4 of this report.

TABLE E-1. COMPLETENESS OF SAMPLE COLLECTION AT NILES BOILER NO. 2

Type of Sample	Completeness (percent)
Flue Gas	
Multi-Metals (Method 29)	100
Modified Method 5 (Method 23)	100
Particulate Mass (Locations 4b, 5b)	100
HEST Sampler	100
Canisters (VOC)	100
VOST (VOC)	100
TO-5 (Aldehydes)	100
Method 26A (Anions)	100
APHA 401 (Ammonia)	100
APHA 808 (Cyanide)	100
Filter Carbon ^(a)	100
Filter Radionuclides(a)	100
Particle Size Distribution	
Impactors	100
Cyclones	100
Solid Samples	
Boiler Feed Coal	100
Bottom Ash	100
Air Heater Ash	. 100
ESP Ash	100
Liquid Samples	
River Water	100
Pond Water	100
Coal Pile Runoff	100

⁽a) Locations 4, 5a only; 5b PSDS filters too lightly loaded for analysis.

E-2. Analytical

E-2.1 Elements (ICP)

Accuracy, precision, and completeness for elemental analysis conducted by CTE are provided in Table E-2. Accuracy was determined by evaluating the recovery of a known amount of a standard solution spiked into a digested sample. Precision was determined by evaluating the relative percent difference of duplicate instrument analyses of a single digested sample. A completeness of 100 percent was achieved for ICP analysis of elements.

Method detection limits (DL) for elements in gas samples were calculated using the following equation:

DL
$$(\mu g/dscm)$$
 = Instrument Detection Limit $(\mu g/mL)$ x $\frac{Digested\ Sample\ Volume\ (mL)}{Gas\ Sample\ Volume\ (dscm)}$

The instrument detection limit in the above equation is determined by calculating three times the standard deviation of background emission.

For example, the detection limit for cadmium in the filter from N-5a-MUM-727 was calculated as follows:

$$DL = 0.005 \ \mu g/mL \ x \ \frac{150 \ mL}{0.3759 \ g} = 2 \ \mu g/g$$

This detection limit in $\mu g/g$ units was then converted to units of $\mu g/dscm$ as follows:

$$DL = 2 \mu g/g \times \frac{0.3759 g}{7.071 dscm} = 0.11 \mu g/dscm$$

TABLE E-2. ACCURACY, PRECISION, AND COMPLETENESS FOR ELEMENT ANALYSIS

Analyte Compounds	A	ccuracy			Precisio	on	
	How Measured	Target (%)	Actual (%) ^(a)	How Measured	Target (%)	Actual (%) ^(a)	Completeness (%)
LIQUID	Spike Recovery	75-125		RPD of Duplicate Analysis	<20		100
Aluminum			84, 95			1.4, 18	
Antimony			85-105			1, 14	
Arsenic			85-113			0-17	
Boron			NA			NA ^(d)	
Barium			43-101			2.7, 3.1	
Beryllium			106-110			ND(c)	
Cadmium			99-102			ND	
Cobalt			95-99			ND	
Chromium			101-103			ND	
Copper			85-102			ND, 25	
Potassium			82-100			3.8, 11	
Lead			103-120			2-14	
Manganese			90-102			ND, 8.2	
Mercury			106			0-17	
Molybdenum			98-111			ND	
Sodium			115 ^(b)			10, 16	
Selenium			73-114			4, 13	
Nickel			98-109			ND	
Silicon			NA			NA	
Titanium			101-104			9.5, 17	
Vanadium			102-106			ND	
SOLID	Spike Recovery	75-125		RPD of Duplicate Analysis	< 20		100
Antimony			80-95			6-11	
Arsenic			78-105			6-10	
Aluminum			NA			1.9-19	
Barium			13-131			0.2-11	
Boron			NA			NA	
Beryllium			94-102			7.4-8.7	
Cadmium			94-101			ND	
Cobalt			95-104			10-30	
Chromium			95-103			1.8-10.3	
Copper			84-98			2.2-123	
Potassium			71-94			3.2-12	
Lead			97-111			4, 4	
Manganese			91-104			0.6-7.9	
Mercury			88-112 ^(e)			NA	•
Molybdenum			92-103			ND	

TABLE E-2. (Continued)

Analyte Compounds	Accuracy						
	How Measured	Target (%)	Actual (%) ^(a)	How Measured	Target (%)	Actual (%) ^(a)	Completeness (%)
Selenium			79-99			1	
Sodium			-45-230			3.1-25	
Nickel			94-105			9.1-19.9	
Silicon			NA			NA	
Titanium			25-100			3.1-7.8	
Vanadium			94-100			3.6-8	
GAS	Spike Recovery	75-125		RPD of Duplicate Analysis	<20		100
Antimony			83-119	•		1-17	
Arsenic			76-115			1-21	
Aluminum			45-127			1.1-4.6	
Barium			87-104			2.4-7.9	
Beryllium			72-108			0-2.2	
Boron			NA			NA	
Cadmium			76-147			ND	
Chromium			87-143			2-8	
Cobalt			81-130 ^(f)			0-18	
Copper			78-114			0-4.4	
Lead			85-109			1-10	
Manganese			89-136			1.8-3.5	
Mercury			80-144			0-36	
Molybdenum			97-144			ND	
Nickel			61-122			0.6-32	
Potassium			26-104			1.8-200	
Selenium			75-117			1-14	
Silicon			NA			NA	
Sodium			35-93			1.3-10	
Titanium			29-102			0-2.2	
Vanadium			86-114			ND-2.6	

⁽a) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

⁽b) Excludes outlier of 12 percent recovery.

⁽c) ND = Analyte not detected in sample therefore RPD could not be calculated.

⁽d) NA = Data not available or analysis not conducted.

⁽e) Recovery from standard reference material.

⁽f) Excludes outlier of 12 percent recovery.

E-2.2 Mercury

Accuracy, precision, and completeness results for CVAA analysis of mercury in gas impinger samples conducted by Battelle are presented in Table E-3. Accuracy was determined by evaluating the recovery of mercury spiked into digested sample matrix. Precision was determined by calculating the relative percent difference of duplicate instrument analyses of a single sample. Accuracy and precision obtained met the target objectives in all cases. A completeness of 100 percent was obtained for all mercury analyses.

TABLE E-3. ACCURACY, PRECISION, AND COMPLETENESS FOR MERCURY ANALYSIS(6)

Analyte/Surrogate Compounds	Accuracy				_		
	How Measured	Target (%)	Actual (%) ^(b)	How Measured	Target (%)	Actual (%) ^(b)	Completeness
Mercury	Spike Recovery	75-125	92-108	RPD of Duplicate Analysis	<20	0-5	100

⁽a) Represents results from analysis of gas samples only.

⁽b) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

E-2.3 Ammonia/Cyanide

A summary of the accuracy, precision, and completeness obtained for the ammonia/cyanide analysis of the gas and liquid samples is provided in Table E-4. Accuracy was determined by calculating the recovery of a known amount of analyte spiked into a sample. Precision was determined by duplicate instrument analysis of a single sample. The accuracy and precision obtained met the target quality objectives in all cases, except for the precision associated with the duplicate analysis of a sample containing ammonia at a level less than the detection limit. A completeness of 100 percent was achieved for all samples.

The method detection limits for ammonia and cyanide in gas samples were determined as follows:

$$DL (\mu g/dscm) = \frac{Instrument \ Detection \ Limit \ (\mu g/sample) *}{Gas \ Sample \ Volume \ (dscm)}$$

For example, the detection limit for ammonia in N-5a-NH₄-727 was calculated as follows:

$$DL = \frac{0.4 \ \mu g/sample}{0.450238 \ dscm} = 0.89 \ \mu g/dscm$$

^{*} Calculated from three times the standard deviation for replicate analysis of low-level samples.

TABLE E-4. ACCURACY, PRECISION, AND COMPLETENESS FOR AMMONIA AND CYANIDE ANALYSIS OF GAS AND LIQUID SAMPLES

Analyte/Surrogate Compounds	Accuracy			***	_		
	How Measured	Target (%)	Actual (%) ^(a)	How Measured	Target (%)	Actual (%) ^(a)	Analytical Completeness (%)
GAS	Spike Recovery			RPD of Duplicate Analysis			
Ammonia		75-125	100-104	•	< 20	0-12 ^(b)	100
Cyanide		75-125	85-105		< 20	2,2	100
LIQUID							
Ammonia		75-125	102-104		< 20	2-17	100
Cyanide		75-125	84-94		< 20	1,6	100

⁽a) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

⁽b) RPD results of 12 at 0.078 and 0.088 μ gN/mL level (0.094 and 0.106 μ g NH₃/mL).

E-2.4 Anions

Accuracy, precision, and completeness results for anion analysis are presented in Table E-5. Accuracy was determined by evaluating the recovery of target analytes spiked into sample matrix as well as analysis of a standard reference material (SRM). Precision was determined by calculating the relative percent difference of duplicate analysis of a single sample. Accuracy and precision obtained met the target objectives in all cases. A completeness of 100 percent was obtained for all anion analyses.

Detection limits for anion analyses of gas samples by ion chromatography were determined by the observation of a calibration standard which when analyzed provided an approximate 3:1 signal-to-noise ratio.

Species which interfered with the chromatographical analysis of a sample, i.e. a species which overloaded the column or eluted near the retention window of interest, were corrected for by sample dilution which in turn required a proportional increase in the detection limit for the sample. The method detection limit is calculated as follows:

DL (μ g/dscm) = Lowest Level Calibration Std (μ g/mL) x Sample Dilution Factor x Extraction Volume (mL)/Gas Sample Volume (dscm)

For example, in the analysis of phosphate in Niles filter sample N-5a-FCL-725, matrix interference in the sample required a dilution of 1:2 to improve the overall chromatography and minimize fouling of the column. The detection limit for the sample was then determined as follows:

 $0.050 \mu g/mL \times 2 \times 20 mL/1.4 dscm = 1.4 \mu g/dscm$

TABLE E-5. ACCURACY, PRECISION, AND COMPLETENESS FOR ANION ANALYSIS

Analyte/Surrogate Compounds	How Measured	Target	Actual	How Measured	Target (%)	Actual	Completenes
Gas (Impinger Solution)	Spike Recovery			RPD of Duplicate Analysis			100
Chloride		75-125	NA	Militaria	<20	9.4	
Fluoride		75-125	NA		< 20	0.7,5.7	
	SRM Analysis						
Chloride	·	143-171 ppm	154,154 ppm				
Fluoride		1.55-2.02 pps	m1.84-1.92 ppm				
Gas (Filter)	Spike Recovery			RPD of Duplicate Analysis			100
Chloride		75-125	98,125		<20	1.2,15	
Fluoride		75-125	99-108		< 20	0.1,1.3	
Sulfate		75-125	100		< 20	0.9,0.2	
Phosphate		75-125	114		< 20	1.1	
	SRM Analysis						
Chloride		143-171 ppm	161,166 ppm				
Fluoride		1.55-2.02 pp	m 1.72-1.96				
0.15		70 1 02 0 -	ppm				
Sulfate		70.1-93.9 pp	m 83.8,88.8 ppm				
Phosphate		0.555-0.779 ppm	0.589 ppm				
Solids/Liquids	Spike Recovery			RPD of Duplicate Analysis			100
Chloride		75-125	95	-	<20	4.6,14	
Fluoride		75-125	106,111		<20	105	
Sulfate		75-125	86		<20	0.47-	
Dhoenhate		75 105	79 112		-20 0	3.1,45	
Phosphate	SRM Analysis	75-125	78-113		<20	0.0	
Chloride	witter . same y and	143-171 ppm	155-175 ppm				
Fluoride		1.55-2.02 pp	m1.62-1.77				
Sulfate		70.1-93.9 pp					
Phosphate		0.555-0.779	ppm 0.648-0.730				
rnosphate		0.555-0.779 ppm	0.648-0.730 ppm				

E-2.5 VOC

E-2.5.1 Gas Samples (VOST)

A summary of the accuracy, precision, and completeness obtained for analysis of VOC in VOST samples is shown in Table E-6. To determine accuracy, each sample was spiked with four surrogate compounds prior to analysis. Recovery of the surrogate spike was then considered as the analytical accuracy. As shown, the surrogate spike recovery met the original objectives of 26-160 percent. Sample N-5A-VOS-730-2 was lost during analysis so a completeness of 96 percent (26 samples reported/27 samples received) was achieved.

A method detection limit of 25 ng/sample was determined by calculating ten times the standard deviation of replicate analyses of a 50 ng standard. Detection limits for individual samples were then calculated by dividing 25 ng/sample by the associated gas sample volume.

TABLE E-6. ACCURACY, PRECISION, AND COMPLETENESS FOR VOC VOST ANALYSIS

	Accuracy						
Analyte/Spike Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target	Actual (%)	Completeness
	Surrogate Spike Recovery						96
d ₄ -1,2-Dichloroethane	,	26-160	42-128		< 20	NA	
d ₈ -Toluene		26-160	63-164, 503 ^(a)		<20	NA	
d ₆ -Benzene		26-160	77-139		<20	NA	
p-Bromofluorobenzene		26-160	26-112		< 20	NA	

⁽a) Interference in sample may have contributed to high percent recovery.

E-2.5.2 Gas Samples (Canister)

A summary of the precision, accuracy and completeness obtained for analysis of VOC in canister samples is shown in Table E-7. Information on accuracy was obtained from a canister spiked with four target compounds. The concentrations of the four components were established by reference to the 41 component calibration cylinder. This cylinder has been recently audited by US EPA and shown to be within \pm 10 percent of the stated values for 15 compounds common to both mixtures. The contents of the spiked canister were directed through the sampling train and into a second canister. Both canisters were analyzed to determined the amount recovered. Analytical precision was determined by repeated analyses (3 times) of a 1/100 dilution mixture from the 41 component calibration cylinder. The four components used during the field spike experiment are reported. A completeness of 100 percent was achieved for canister analyses.

Detection limits for VOC in canister samples were calculated as follows:

$$DL (ppb) = \frac{Concentration \ of \ Stds \ (ppb)}{Average \ of \ Range \ of \ Std \ Peak \ Areas \ (all)} \times 3 \times (Peak \ Area \ Noise)$$

The calibration cylinder contained the 41 target components each at a nominal concentration of 200 ppb. The cylinder was dynamically diluted to the 6 ppb level. Using the selective ion monitoring mode of the GC/MS, area counts from 850,000 to 1,700,000 were obtained for the target compounds. The peak area noise was approximately 35,000 area units. No changes in electron multiplier gain was made during the study so the above responses hold throughout the time period. With these results, the actual detection limit achieved was calculated as follows:

$$DL (ppb) = \frac{6 ppb}{((1,700,000 + 850,000)/2)} \times 3 (35,000) = 0.5 ppb$$

The detection limit in ppb units was then converted to $\mu g/dscm$ units by multiplying by a conversion factor. For example, 1 ppb of trichlorofluoromethane at 0°C and 760 mm is equal to 6.11 $\mu g/dscm$; therefore the converted detection limit was 3.06 $\mu g/dscm$.

TABLE E-7. ACCURACY, PRECISION, AND COMPLETENESS FOR VOC CANISTER ANALYSES

	Accuracy			Precision			_
Analyte/Spike Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual	Completeness (%)
	Spike of Samplin Train with Canister	g		RSD of Replicate Analysis of Standard Cylinder	f		100
Benzene	$25.6 \ \mu g/m^3$	75-125	108	-	< 20	± 24	
Toluene	$23.0 \ \mu g/m^3$	75-125	122		< 20	± 13	
Ethylbenzene	$25.6 \mu \text{g/m}^3$	75-125	109		< 20	± 12	
Styrene	19.2 $\mu g/m^3$	75-125	102		< 20	± 12	

E-2.5.3 Liquid Samples

QA/QC results for the analysis of VOC in liquid samples are presented in Table E-8.

Each sample was spiked with three surrogate compounds prior to analysis. All of the samples fell outside of surrogate recovery limits (all over-recovered) except N-9-PRL-730, the trip blank and field blank. All of the samples were re-analyzed except for N-9-PRL-730 MS and MSD. Re-analysis of samples N-9-PRL-726, N-9-PRL-726 MS (matrix spike), N-9-PRL-726 MSD (matrix spike duplicate), N-10-PRL-726 were still outside surrogate recovery limits. Generally this indicates a matrix interference is present.

Two matrix spikes and matrix spike duplicates were analyzed and one MS/MSD pair was re-analyzed. The Relative Percent Difference (RPD) for nearly all of the spiked compounds was within the target range of ±25 percent.

Limits for surrogate recoveries as they appear in Table E-8 were taken directly from Method 8240. Limits for spike recoveries as they appear in Table E-8 were taken from Method 8240 QC Acceptance Criteria Table.

TABLE E-8. ACCURACY, PRECISION, AND COMPLETENESS FOR VOC ANALYSIS OF LIQUID SAMPLES

	A	ccuracy		******	Precision	on	
Analyte/Surrogate Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target (%)	Actual (%)	Completeness
	Surrogate Spike Recovery						100
1,2-Dichloroethane-d ₄		76-114	92-159 ⁽⁶⁾	RPD of Matrix Spike/ Matrix Spike Duplicate	NA ^(a)	NA	
Toluene-d ₈		88-110	89-157 ^(b)		NA	NA	
4-Bromofluorobenzene		86-115	89-164 ^(b)		NA	NA	
	Matrix Spike Recovery						100
Benzene		37-151	141-173		25	2-8	
Bromomethane		D-242	70-146		25	2-43	
Bromoform		45-169	95-170		25	7-13	
Carbon tetrachloride		70-140	103-110		25	3-19	
Chlorobenzene		37-160	96-126		25	6-23	
Chloromethane		D-273	78-112		25	12-19	
1,1-Dichloroethane		59-155	80-123		25	4-31	
1,2-Dichloroethane		49-155	100-143		25	3-17	
cis-1,3-		D-227	96-158		25	1-12	
Dichloropropylene							
trans-1,3-		17-183	117-154		25	2-12	
Dichloropropylene							
Ethylbenzene		37-162	137-162		25	3-12	
Methylene chloride		D-221	74-99		25	5-36	
Toluene		47-150	127-177		25	0.3-5	
1,1,1-Trichloroethane		52-162	83-140		25	3-40	
1,1,2-Trichloroethane		52-150	95-181		25	1-19	
Trichloroethylene		71-157	90-129		25	2-7	
Vinyl chloride		D-251	76-84		25	5-30	

D = detected.

⁽a) NA = not available.

⁽b) All samples exceeding target range were reanalyzed.

E-2.6 PAH/SVOC

E-2.6.1 Gas and Solid Samples

Accuracy, precision, and completeness results for PAH/SVOC analysis of gas and solid samples are presented in Table E-9. Accuracy was determined by recovery of perdeuterated PAH spike compounds added to the samples prior to extraction. In most cases, spike recoveries met the target objective of 50 to 150 percent. Precision was determined by evaluating the relative standard deviation of calibration standard analyses. The average RSD for three calibration standards, $0.05 \text{ ng/}\mu\text{L}$, $0.1 \text{ ng/}\mu\text{L}$, and $0.5 \text{ ng/}\mu\text{L}$ is presented in Table E-9. As shown, this average RSD is below the target 30 percent in all cases. Individual RSD for these three standards were also below the 30 percent target. A completeness of 100 percent was achieved for the gas and solid samples.

The estimated detection limit for PAH is 0.01 ng on column and for SVOC is 0.05 ng on column with a $1-\mu L$ injection. At these concentration levels, the signal-to-noise ratio is about 3. The detection limit for PAH/SVOC was calculated using the following equation:

$$DL = \frac{Estimated\ Detection\ Limit\ Concentration\ x\ Final\ Volume\ of\ Extract\ Analyzed}{Gas\ Sample\ Volume\ x\ Fraction\ of\ Extract\ Analyzed}$$

For example, the detection limit for hexachloroethane in N-4-MM5-X-726 was calculated as follows:

$$\frac{0.05 \ ng/\mu L \ x \ 1000 \ \mu L}{6.5317 \ dscm \ x \ 1.0} = 7.7 \ ng/dscm$$

TABLE E-9. ACCURACY, PRECISION, AND COMPLETENESS FOR PAH/SVOC ANALYSIS OF GAS AND SOLID SAMPLES

	A	ccuracy		.· <u> </u>	Precisio	on	
Analyte/Surrogate Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target	Actual (%)	Completenes
	Recovery of Perdeuterated PAH Spike						
GAS	ran spike						100
d ₁₂ -Chrysene		50-150	56-125				100
u ₁₂ -cm ysone		30-130	JU-12J				
d ₁₂ - Benzo(k)fluoranthene		50-150	41-125				
SOLID							100
d ₁₂ -Chrysene		50-150	21-128				-
d ₁₂ -		50-150	30-126				
Benzo(k)fluoranthene		** -	- - -				
`,			,	RSD of Calibration Standard Analysis	< 30		
GAS/SOLID				7that y 518			
Benzylchloride						15.9	
Acetophenone						15.1	
Hexachloroethane						11.3	
Naphthalene						7.5	
Hexachlorobutadiene						11.2	
2-Chloroacetophenone						8.2	
1-Methylnaphthalene						7.4	
2-Methylnaphthalene						5.3	
Hexachlorocyclopenta-						12.3	
diene							
Biphenyl						6.6	
Acenaphthylene						5.2	
2,6-Dinitrotoluene						7.9	
Acenaphthene						6.4	
Dibenzofuran						6.9	
2,4-Dinitrotoluene						8.8	
Fluorene						6.1	
Hexachlorobenzene						6.5	
Pentachlorophenol						11.2	
Phenanthrene Anthracene						11.6	
						6.7	
Fluoranthene						13.2	

TABLE E-9. (Continued)

_	Accuracy			Precision			
Analyte/Surrogate Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target	Actual (%)	Completeness
				RSD of			
				Calibration			
				Standard Analysis			
Pyrene				Allarysis		9.2	
Benz(a)anthracene						8.6	
Chrysene						6.0	
Benzo(b&k)fluoranthene						8.0	
Benzo(e)pyrene						7.5	
Benzo(a)pyrene						9.2	
Indeno(1,2,3-c,d)pyrene						10.5	
Dibenzo(a,h)anthracene						11.1	
Benzo(g,h,i)perylene						6.5	

E-2.6.2 Liquid Samples

Accuracy, precision, and completeness results for PAH/SVOC analysis of liquid samples are presented in Table E-10. Each sample was spiked with eight surrogate compounds prior to analysis. Two of the surrogates do not have established recovery limits. All samples were within surrogate recovery limits except sample N-9-PRL-730 Trip Blank which had 168 percent recovery for nitrobenzene-d₅.

Two matrix spikes and matrix spike duplicates were analyzed. The Relative Percent Difference (RPD) for one set of MS/MSD's was out of the target limit of ± 25 percent. The matrix spike duplicate sample in this set exhibited lower recovery for all of the spiked compounds including the surrogates. The other matrix spike/matrix spike duplicate pair was within the RPD target of 25 percent with the exception of pentachlorophenol which had a RPD of 25.94.

Limits for surrogate recoveries as they appear in these tables were taken directly from Method 8270. Limits for spike recoveries as they appear in these tables were taken from Method 8270 QC Acceptance Criteria Table.

TABLE E-10. ACCURACY, PRECISION, AND COMPLETENESS FOR PAH/SVOC ANALYSIS OF LIQUID SAMPLES

	A	ccuracy			Precision		
Analyte/Surrogate Compounds	How Measured	Target (%)	Actual	How Measured	Target	Actual (%)	Completeness
	Surrogate Spike						100
2 Elvers-hand	Recovery	21-100	26-56	NA ^(a)	NA	NA	
2-Fluorophenol		10-94	20-30 19-41	NA	NA NA	NA NA	
Phenol-d ₅		10-94 NE ^(b)	39-72				
2-Chlorophenol-d ₄			- · · · ·	NA	NA	NA	
1,2-Dichlorobenzene-d ₄		NE	50-139	NA	NA	NA	
Nitrobenzene-d ₅		35-114	41-168	NA	NA	NA	
2-Fluorobiphenyl		43-116	41-80	NA	NA	NA	
2,4,6-Tribromophenol		10-123	41-74	NA	NA	NA	
Terphenyl-d ₁₄		33-141	39-139	NA	NA	NA	
	Matrix Spike Recovery			RPD of Matrix Spike and Matrix/ Spike Duplicate			100
Phenol		5-112	28,41	Duplicate	< 25	5 41	
2-Chlorophenol		23-112	55,66		< 25	•	
1.4-Dichlorobenzene		20-124	55,00 69,77		< 25	- •	
1,2,4-Trichlorobenzene		44-142	99,110			12,16	
4-Chloro-3-		22-147	71,94		< 25		
Methylphenol		LL-14/	(1,74		× 23	4,10	
Acenaphthene		47-145	84,94		< 25	2,39	
4-Nitrophenol		D-132	46,52		< 25	16,61	
2,4-Dinitrotoluene		39-139	92,104		< 25	· ·	
			=			15,47	
Pentachlorophenol		14-176	57,63		< 25	26,49	
Pyrene		52-115	74,81	·	< 25	17,28	

D = detected.

⁽a) NA = not available.

⁽b) NE = not established.

E-2.7 Dioxins/Furans

Accuracy, precision, and completeness results for dioxin/furan analysis are presented in Table E-11. Accuracy was determined by evaluating recovery of $^{13}C_{12}$ -labelled internal standards spiked into the samples prior to extraction and by evaluating recovery of native dioxins/furans spiked into a matrix spike sample. In all cases except one sample for 1,2,3,4,7,8-HxCDD, recoveries of internal standards and matrix spike compounds met the accuracy objective of 40 to 120 percent. Precision was determined by calculating the relative standard deviation of internal standard recoveries obtained for samples. As shown, the precision obtained met the target objective of <25 percent in all cases.

The detection limit for dioxins/furans in gas samples was calculated using the following equation:

For example, actual detection limits were calculated for 2,3,7,8-tetrachlorodibenzo-p-dioxin in N-5a-MM5-726 as follows:

Filter DL =
$$\frac{(2+2)}{(2305+2808)} \times \frac{2000 \ pg}{1.068} \times \frac{2.5}{2.438081 \ dscm} = 1.5 \ pg/dscm$$

$$XAD DL = \frac{(5+5)}{(1669+2061)} \times \frac{2000 pg}{1.068} \times \frac{2.5}{2.438081 \ dscm} = 5.15 \ pg/dscm$$

The detection limit for the total sample was then calculated as the average of the filter + XAD detection limits as follows:

N-5a-MM5-726 total detection limit =
$$\frac{1.50 \text{ pg/dscm} + 5.15 \text{ pg/dscm}}{2}$$
 = 3.33 pg/dscm

TABLE E-11. ACCURACY, PRECISION, AND COMPLETENESS FOR DIOXIN/FURAN ANALYSES

		Accuracy		Precision			_
Analyte Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target (%) (RSD)	Actual (%) (RSD)	Completeness
	Spike Recovery			NA			100
2378-TCDD		40-120	97.1-101.2		NA	NA	
12378-PeCDD		40-120	99.5-105.2		NA	NA	
123478-HxCDD		40-120	97.8- 123.3 ^(a)		NA	NA	
123678-HxCDD		40-120	92.2-97.9		NA	NA	
123789-HxCDD		40-120	99.6-114.8		NA	NA	
1234678-HpCDD		40-120	96.1-111.3		NA	NA	
OCDD		40-120	98.8-105.3		NA	NA	
2378-TCDF		40-120	92.0-96.0		NA	NA	
12378-PeCDF		40-120	90.9-102.8		NA	NA	
23478-PeCDF		40-120	90.3-98.4		NA	NA	
123478-HxCDF		40-120	97.7-99.4		NA	NA	
123678-HxCDF		40-120	90.5-95.6		NA	NA	
123789-HxCDF		40-120	91.5-93.6		NA	NA	
234678-HxCDF		40-120	98.4-98.7		NA	NA	
1234678-HpCDF		40-120	84.5-88.5		NA	NA	
1234789-HpCDF		40-120	100.3- 106.3		NA	NA	
OCDF		40-120	90.5-105.5		NA	NA	
2378-TCDD-13C12		40-120	66-94	RSD of	< 25	8.7	
12378-PeCDD-13C12		40-120	55-107	Standard	< 25	18.0	
123478-HxCDD-13C12		40-120	75-107		< 25	9.2	
123678-HxCDD-13C12		40-120	71-95		< 25	6.5	
1234678-HpCDD-13C12		40-120	61-88		< 25	11.8	
OCDD-13C12		40-120	52-82		< 25	12.6	
2378-TCDF-13C12		40-120	58-84		< 25	9.9	
12378-PeCDF-13C12		40-120	48-89		< 25	17.3	
23478-PeCDF-13C12		40-120	51-93		< 25	15.6	
123478-HxCDF-13C12		40-120	65-88		< 25	6.6	
123678-HxCDF-13C12		40-120	68-93		< 25	7.0	
123789-HxCDF-13C12		40-120	70-92		< 25	6.0	
234678-HxCDF-13C12		40-120	70-92		< 25	7.9	
1234678-HpCDF-13C12		40-120	67-93		< 25	9.1	
1234789-HpCDF-13C12		40-120	59-83		< 25	7.6	
2378-TCDD-37CL4		40-120	81-97		< 25	4.8	

NA = Not available.

(a) Outside target range.

E-2.8 Aldehydes

Accuracy, precision, and completeness results for analysis of aldehydes in gas and liquid samples are presented in Table E-12. Accuracy was determined by recovery of analytes spiked into water. As shown, except for a 179 percent recovery of formaldehyde spiked into water at or near the method detection limit, all recoveries met the target objective of 50 to 150 percent. The precision was determined by the relative standard deviation of standard analyses and also met the target objectives. Completeness of 100 percent was obtained for both gas and liquid samples.

Method detection limits for aldehydes in gas samples were calculated using the following equation:

$$DL(\mu g/dscm) = A_{\min} x \frac{C_{std}(\mu g/mL)}{A_{STD}} x \frac{V_{e-avg}(mL)}{V_{sampled}(dscm)} x \frac{MW_{neat}}{MW_{DER}}$$

where:

DL = Detection Limit

A_{min} = Minimum detectable peak area of carbonyl

A_{std} = Peak area of carbonyl derivative in standard solution

C_{std} = Concentration of carbonyl derivative in standard solution

 V_{e-avg} = Average final volume of DNPH-acetonitrile solution

 $V_{\text{sampled}} = Average volume of air sampled$

MW_{neat} = Molecular weight of neat carbonyl compound

MW_{DER} = Molecular weight of carbonyl derivative.

For Niles, actual detection limits were calculated as follows:

$$4300 \ x \ \frac{2 \ \mu g/mL}{334293} \ x \ \frac{31.7 \ mL}{0.05853 \ dscm} \ x \ \frac{30.03}{210} = 2 \ \mu g/dscm$$

TABLE E-12. ACCURACY, PRECISION, AND COMPLETENESS FOR ALDEHYDE ANALYSES

	A	ccuracy			Precisio	on	_
Analyte/Spike Compounds	How Measured	Target (%) ^(a)	Actual (%) ^(a)	How Measured	Target (%)(a)	Actual (%) ^(a)	Completeness (%)
GAS/LIQUID	Spike Recovery			RSD of Standard Analysis			100
Formaldehyde		50-150	114-122 ^(b)		± 15	0.45	
Acetaldehyde		50-150	85-100		± 15	0.57	
Acrolein		50-150	NA		± 15	0.32	
Propionaldehyde		50-150	81-95		± 15	0.59	
LIQUID	Spike Recovery			RSD of Standard Analysis			100
Formaldehyde		50-150	114-122 ^(b)	/ Liai y Sis	± 15	0.45	
Acetaldehyde		50-150	85-100		± 15	0.57	
Acrolein		50-150	NA		± 15	0.32	
Propionaldehyde		50-150	81-95		± 15	0.59	

⁽a) Except where indicated, range represents range of results for multiple samples, two numbers separated by a comma represents results for two samples, and single number represents results for single sample or determination.

⁽b) Excludes 179 percent recovery for spike at detection limit of method.

⁽c) NA = Not analyzed.

E-2.9 Radionuclides

Accuracy, precision, and completeness results for radionuclide analysis are presented in Table E-13. Accuracy was determined by evaluating the recovery of cesium-137 spiked into sample matrix. Precision was determined by evaluating results of duplicate sample analyses. The precision achieved met the target objective of ±3 standard deviations; relative percent differences (RPD) are provided in Table E-13 for comparability with other analytical data. A completeness of 100 percent was obtained for all radionuclides analyses.

The method detection limit for radionuclides was calculated using the following equation:

$$MDC = \frac{4.65 \sqrt{BKG} + 2.71}{(2.22)(EFF)(AVOL)(CTIME)(Ab)(D)}$$

where:

MDC = Minimal detectable concentration

BKG = Background counts

EFF = Counting efficiency

AVOL = Aliquot volume (g or L)

CTIME = Count time (min)

Ab = Abundance of emission

D = Decay correction

2.22 = Conversion from dpm to pCi

4.65, 2.71 = Constants.

This equation is derived from the following reference:

"Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements", L. A. Currie, NUREG/CR-4007, U.S. Nuclear Regulatory Commission, September 1984.

TABLE E-13. ACCURACY, PRECISION, AND COMPLETENESS FOR RADIONUCLIDE ANALYSIS

	Accuracy			Precision			
Analyte/Surrogate Compounds	How Measured	Target (%)	Actual (%)	How Measured	Target	Actual (%)	Completeness
	Spike Recovery			RPD of Duplicate Analysis ^(b)			100
Cs-137		NA	100-109				
Pb-210						5	
Pb-212						14	
Ra-226						1	
Ra-228						20	
Th-234						10	
U-234						49	
U-235					**	33	

⁽a) Precision not provided for radionuclides not detected in both sample and duplicate.

NA = Not available.

⁽b) All duplicate results agreed to with ±3 standard deviations target objective; RPD provided for comparability with other analytical data.

E-3. Method Detection Limit

Approximate emission detection limits obtained for gas samples in which analytes were not detected are listed in Table E-14.

TABLE E-14. EMISSION DETECTION LIMITS

	Actual Emission Detection Limit (μg/dscm) ^(a)	Target Emission Detection Lin (μg/dscm)
Element		
Мо	NC	1.5
3	NC	1.2
БЬ	0.7	0.3
As	NC	0.06
la	NC	0.3
le	NC	0.3
Cd Common	0.2	0.3
Cr Cr	NC	1.2
ხ	NC	0.06
Иn	NC	0.3
łg	0.02	0.03
Ji	NC	1.2
e	NC	0.12
,	NC	0.6
Cu	NC	0.6
Co	0.3	0.9
Ammonia	1	750
Cyanide	NC	191
nions		
?-	NC	3
21 ⁻	NC	3
PO ₄ =	30	30
O ₄ =	NC	7.5
PAH/SVOC	0.4-20	0.1-10 ng/dscm ^(b)
Dioxins/Furans		•
CDD/TCDF	0.003	0.03 ng/dscm
eCDD/PeCDF	0.005	0.053 ng/dscm
lxCDD/HxCDF	0.005	0.053 ng/dscm
HpCDD/HpCDF	0.005	0.053 ng/dscm
OCDD/OCDF	NC	0.08 ng/dscm
Aldehydes	2	2
VOC - Canister	4	6
VOC - VOST	6	1.3-7.5

⁽a) Approximate emission detection limit obtained in sample analyses. Values for PAH/SVOC and dioxins/furans are in ng/dscm.

⁽b) Calculated target emission detection limit will range from 0.1 to 10 ng/dscm depending upon SVOC compound and matrix.

NC = Not calculated since analyte concentration above method detection limits in samples.

APPENDIX F ANALYTICAL PROTOCOL

F-1. Element Analytical Protocols

Elements in flue gas, solid, and liquid samples were analyzed by various methods (ICP, GFAA, CVAA) according to the procedures described in the QAPP. Specific deviations from those procedures were as follows:

- (1) Samples sent to CTE for analysis instead of Battelle. In order to meet the reporting deadline, it was necessary to send process solid, process liquid, PSDS filter, and gas samples (excluding impinger samples for mercury analysis) to Commercial Testing and Engineering Company (CTE) in Denver, Colorado for analysis. CTE followed the Quality Assurance Plan for element determinations with the following exceptions:
 - The analyses of solid samples by CTE for mercury were accomplished by a double gold film amalgamation CVAA technique. No spike samples were performed due to the use of a solid sample matrix. However, recoveries for solid reference materials were within the limits established for this program.
 - Silicon, aluminum, titanium, potassium, and sodium in solid samples (boiler feed coal, bottom ash, air heater ash, and ESP ash) were determined by X-ray fluorescence spectroscopy, in accordance with ASTM D4326, instead of ICP.
- (2) The H₂O₂ reagent blank was lost during sample preparation. A water reagent blank was not collected. Train blanks are not corrected for these reagent blanks. Sample results, by the process of subtracting train blank results, are corrected for contributions from these reagents.
- (3) Filter reagent blanks analyzed for elements had unexplained outlying results in several cases. Duplicate Pallflex 102 mm filter reagent blanks were analyzed. Results for one of these reagent blanks were as expected with element concentrations equivalent to or significantly below sample results. The second Pallflex 102 mm filter reagent blank had extremely high concentrations of aluminum, potassium, and sodium which were considered outliers and not considered in blank corrections. Likewise in the analysis of triplicate Pallflex 86 mm filter reagent blanks, outlying results were obtained for aluminum and sodium in one blank and for potassium in a second blank. Again, these outlying results were not included in reagent blank corrections.
- (4) The probe rinses from the high volume samples (N-5A-HVS-731-1, -2) were both labelled as -1 in submitting these samples to the subcontractor laboratory for element analysis. The analytical results for the two rinse samples provided no information to distinguish which sample was associated with soot blowing

- and which with normal operations. The assignment of the samples as -1 or -2 was therefore arbitrary in determining the total element concentration (filter plus rinse) for N-5A-HVS-731-1 and -2.
- (5) Problems with Si and B determinations of Method 29 samples by CTE. Boric acid was used to complex excess hydrofluoric acid after microwave digestion by CTE. Hydrofluoric acid may also react with glassware or the glass mixing chamber of the ICP analyzer, and may interfere with silicon results. Thus CTE has not reported Si and B results for some samples.
- (6) The Method 29 filter was analyzed separately from the combined acetone/acid probe rinses for ICP and GFAA elements. This deviation was required to allow evaluation of the particle size distribution of elements in gas emissions.

F-2. Ammonia/Cvanide Protocols

Samples were analyzed for ammonia and cyanide according to the procedures stated in the OAPP.

F-3. Analytical Protocol for Anions

Summary of Method for Anion Analysis by Ion Chromatography

Anions of interest are separated and measured using a Dionex DX300 ion chromatography system comprised of a guard column, separator column, MicroMembrane suppressor, and conductivity detector. The separator column selectively separates ions based upon their affinity for an ion-exchange resin. The suppressor converts the eluted ions to acids which are then measured by a conductivity meter. Identification of the ions is made by their retention time on the column. Quantification is done by comparing peak height or area responses to those of calibration standards.

Deviations from Method 26A

(1) The analysis of EPA Performance Evaluation Samples (WP029) was used instead of EPA "Audit Samples" designated in Section 7.7.1 of Method 26A.

There is no effect on results because of this deviation from Method 26A. The acceptable range for either must be analytically achieved to assure method accuracy. The target values are documented by the EPA and the analysis results are recorded in the project laboratory record book.

(2) Calibration standards were prepared in deionized water instead of 0.1 N H₂SO₄ as stated in Section 5.2 of Method 26A.

As the majority of the analyses required dilution in deionized water to conform to the analytical range of the detector, deionized water was the appropriate solvent for the calibration standards. There should be no adverse effect on results from this alteration.

Deviations from Method 300.0

(1) The instrument calibration is verified approximately each hour of operation with the analysis of an Instrument Calibration Verifier (ICV) which has a tolerance of 20 percent from the known value. Section 9.4 of Method 300.0 states that the tolerance should be 10 percent. Although 10 percent is achievable precision (see RPDs of duplicates), ICV's require 20 percent because they are analyzed around the clock where temperature changes contribute to a small amount of instrumental drift above 10 percent.

Deviations from the OAPP

- (1) The Custody During Lab Analysis (5.1.3.3) section states that quality control samples will be documented in a bound lab record book and assigned an LRB number. The ion chromatography lab uses a sample log for all incoming samples from which a unique 4-digit number is assigned. Copies of logged samples will be entered into a bound LRB. The chain-of-custody-form copies will serve as a record of the personnel involved and the times involved in sample-handling transactions.
- Data Quality Objectives (Table 5-4) should state that a standard reference material (EPA WP029) will be used as an accuracy determiner when the matrix spike is not applicable, i.e., the spiked sample is unmeasurable because of column and/or detector overload or because of matrix dilution necessary for linear range detection.
- (3) The target values for the WP029 samples were achieved with each calibrated sample run except one. The result of WP29 chloride for Niles, Run #3, Solids, was 176 ppm. The acceptable range is 143-171 ppm. The oversight

was discovered too late to be corrected. Considering the fact that all of the other QC analyses for this sample run and specifically those surrounding this analysis were within control limits, the run was not invalidated.

F-4. Analytical Protocol for VOC

F-4.1 VOST Samples

Analysis of VOST sorbent traps for VOC was conducted as described in the QAPP, according to the provisions of SW-846 Method 5041, using thermal desorption GC/MS. Each sampled pair of VOST traps was placed in a heated desorption unit and purged with organic-free nitrogen or helium. The purge gas flow transferred VOC desorbed from the VOST traps to a cold trap for focusing. Heating of the cold trap released collected VOC in a small volume onto the inlet of the GC column. The VOC were then determined by temperature programmed chromatography with detection by low resolution mass spectrometry. Internal standards were used to quantify the VOC. The one deviation from plan was that hexane was not determined in VOST samples.

F-4.2 Canister Samples

Canister samples were analyzed with a gas chromatograph equipped with a mass spectrometric detector. Upon receipt, the initial pressure of each can was recorded and the can was filled with zero air to facilitate sample extraction. The initial and final pressures were used to determine the dilution correction factor. Since acidic gases have been shown to strip the analytical column of bonded liquid phase within a short time period sampled air from the canister was first directed through a sodium bicarbonate trap to reduce the content of acidic gases. The use of alkaline water was originally specified in the Analytical Management Plan but was shown prior to the field study to partly remove several of the target compounds when challenged with the 41 component calibration mixture. The effluent from the sodium bicarbonate trap was then directed to an adsorbent trap (Carbopak B/ Carbosieve S-III) to preconcentrate the target VOC species. A six port valve and thermal desorption step were used to inject the adsorbed material onto the analytical column. The

column was temperature programmed from -50 to 200°C to resolve the VOC. Selective ion monitoring was used to quantify the target species. However, sufficient acidic gases were still present in the injected sample that prohibited the operation of the mass spectrometer until 11 minutes into the run. As a result, the first six species on the 41 component target list were not analyzed. A method detection level of 0.5 ppb was achieved with a sample volume of 60 cc.

F-4.3 Liquid VOC Samples

Volatile organic compounds (VOC) in liquid samples were analyzed by Zande Environmental Laboratories using purge and trap gas chromatography/mass spectrometry. EPA SW846 Method 8240 was followed for the analysis of these samples. All samples were initially analyzed within 14 days of receipt at the laboratory.

Calibration curves were generated and the appropriate Calibration Check Compounds (CCC) and System Performance Compounds (SPCC) were within the limits stated in Method 8240. The system was initially tuned with 4-bromofluorobenzene prior to analysis of the initial calibration curve. An attempt to tune the system every 12 hours of operation was made, but the 12 hour window was exceeded by 10 minutes in one instance and 20 minutes in another. A couple of tunes also failed to meet the abundance ratio criteria found in Method 8240. Continuing calibration standards were analyzed every twelve hours and in all instances but two met the continuing calibration criteria required by Method 8240. There were no target analytes present in any of the samples.

F-5. Analytical Protocol for PAH/SVOC

F-5.1 Gas and Solid Samples

The MM5 samples were prepared according to the Niles Analytical Plan. The MM5 filter and probe rinse filter were spiked with known amounts of d_{12} -chrysene and d_{12} -benzo(k)fluoranthene before Soxhlet extraction. If dioxin/furan analysis was required for the sample, known amounts of $^{13}C_{12}$ -labelled dioxin/furan internal standards were also spiked

onto the sample. The filters were then extracted with dichloromethane (DCM) for 18 hours. Note that in the Niles QAPP the extraction time is indicated as 16 hours, but the actual extraction time for all the samples was 18 hours. The DCM extract was combined with the filtrate from the probe rinse and concentrated by Kuderna-Danish (K-D) evaporation. If dioxin/furan analysis was required, the combined extract was split into two equal portions: one portion for SVOC analysis and one portion for dioxin/furan analysis. Cyclone samples collected at Locations 4a and 5a were spiked with perdeuterated PAH and extracted with DCM for 18 hours. The DCM extracts were concentrated to 1 mL by K-D evaporation for silica gel column chromatography.

The XAD-2 samples were spiked with perdeuterated PAH and/or ¹³C-labelled dioxin/furan and extracted with DCM. The condensate was adjusted to pH 7 and extracted with DCM according to the QAPP. The XAD-2 extract was combined with the module rinse and condensate, and concentrated to 1 mL for silica gel column chromatography.

Aliquots of the solid process samples were spiked with perdeuterated PAH and extracted with DCM for 18 hours. The DCM extracts were concentrated to 1 mL for silica gel column chromatography.

The DCM extract was solvent exchanged into hexane (C_6) and applied to a silica gel column. The column was packed with 5 percent water deactivated silica gel with C_6 . Three elution solvents, C_6 , C_6 /DCM (50/50), and methanol were applied to the column. The C_6 /DCM fractions were concentrated to 1 mL with K-D evaporation and further concentrated to 100 μ L with nitrogen evaporation for GC/MS analysis. Some of the C_6 /DCM fractions of XAD-2 extracts were diluted to 1 mL or more to minimize sample matrix effects for GC/MS analysis. The methanol fractions were concentrated to 1 mL, evaporated almost to dryness, and solvent exchanged into 1 mL of DCM, however these fractions were not analyzed. The only target analyte expected in this fraction is quinoline for which data are not provided.

A Finnigan TSQ-45 GC/MS/MS operated in GC/MS mode equipped with an INCOS 2300 data system was employed. Helium was the GC carrier gas and a 70 ev electron beam was used. The MS was operated in the selected ion monitoring mode. Ion peaks monitored by MS are the molecular ions and characteristic fragment ions of target analytes.

Identification of the target analytes was based on the correct molecular ion, correct fragment

ions, and the correct retention time relative to the internal standard. Quantification of each target analyte followed the method described in the Niles QAPP.

F-5.2 Liquid SVOC Samples

Semivolatile organic compounds (SVOC) in liquid samples were extracted and analyzed by Battelle using liquid/liquid extraction, and analysis by gas chromatography/mass spectrometry. EPA SW846 Method 3560 and 8270 was followed for the analysis of these samples. All samples were initially extracted within 7 days of receipt at the laboratory and the extracts analyzed within 40 days.

One liter aliquots of each sample were fortified with the appropriate surrogate compounds to monitor extraction efficiency, serially extracted three times with methylene chloride, concentrated to 1 mL, fortified with internal standards and analyzed on an HP 5970 MSD. Every sample with the exception of blanks and spiked blanks formed emulsions during the base/neutral extraction. Due to the formation of emulsions, during the base/neutral extraction, each 60 mL aliquot of extract was collected in a centrifuge bottle, centrifuged, the organic removed and the remainder added back to the separatory funnel prior to the next addition of solvent. Once the samples were acidified, emulsions did not form and the samples were processed without centrifugation. No problems were encountered in the concentration step.

Calibration curves were generated and the appropriate Calibration Check Compounds (CCC) and System Performance Compounds (SPCC) were within the limits stated in Method 8270.

The system was initially tuned with decafluorotriphenylphosphine prior to analysis of the initial calibration curve. The system was also tuned every twelve hours of operation and met the required ion abundances. Continuing calibration standards were analyzed every twelve hours and in all instances met the continuing calibration criteria required by Method 8270 for CCCs and SPCCs. Method 8270 allows for 30 percent RSD on CCCs and this criteria was used. The QAPP incorrectly stated 25 percent RSD.

F-6. Analytical Protocol for Dioxins/Furans

Samples of the vapor phase and particulates from the MM5 sampling train were extracted for dioxin/furan analysis with the same procedures used for PAH/SVOC gas and solid samples. The front half of the MM5 train, including the probe rinse and particulate filter, were prepared and analyzed for dioxins/furans in the solid phase and the back half of the MM5 train, including XAD-2 resin, module rinse and condensate, were prepared and analyzed for dioxins/furans in the vapor phase as outlined in the QAPP.

The solid phase sample was prepared by filtering the probe rinse, combining the probe rinse filter and the particulate filter in a Soxhlet extractor, spiking with $^{13}C_{12}$ -labeled dioxin/furan standards and extracting with methylene chloride. The extract was combined with the probe rinse filtrate and the combined solution was split into two equal portions, one of which was further processed for dioxin/furan analysis. The vapor phase sample was prepared by Soxhlet extracting with methylene chloride the XAD-2 resin spiked with $^{13}C_{12}$ -labeled dioxin/furan standards. The XAD-2 extract was combined with the module rinse and condensate extracts. The combined solution was split into two equal portions, one of which was further processed for dioxin/furan analysis.

Both the solid and vapor phase samples were processed through dioxin/furan cleanup procedures which included spiking the extracts with 2,3,7,8-TCDD-³⁷Cl₄ cleanup standard, washing with acidic and basic solutions, and processing through acid/base silica, alumina, and carbon cleanup columns. The clean extracts were concentrated and spiked with 1,2,3,4-TCDD-¹³C₁₂ and 1,2,3,7,8,9-HxCDD-¹³C₁₂ recovery standards. Samples were then analyzed for dioxins/furans by gas chromatography/ high resolution mass spectrometry.

The sample preparation procedures outlined above and described in the QAPP differ somewhat from the preparation procedure detailed in EPA Method 23. A major difference is that the sampling trains were prepared to obtain two sample fractions, one representative of the solid phase and one representative of the vapor phase. Other differences include:

• The Soxhlet equipment was pre-extracted and samples extracted with methylene chloride rather than toluene. Methylene chloride was the preferred extraction solvent for obtaining volatile PAH analytes. As stated in the QAPP, both dioxin/furan and PAH data were obtained by extracting one sample and splitting the extract into two portions, one for dioxin/furan specific cleanup and one for

PAH specific cleanup. To insure recovery of the volatile PAHs while not affecting the efficiency of extracting dioxins/furans, methylene chloride was used as the extraction solvent.

- Samples were Soxhlet extracted for 18 hours rather than 16 as specified in Method 23 and the QAPP. The additional extraction time should not have impacted the analytical results.
- The calibration and spiking solutions used were at concentrations recommended by EPA Method 1613. Method 1613 solution concentrations vary slightly from Method 23 and also include additional ¹³C₁₂-labeled internal standards. The additional labeled internal standards provide better accuracy in identifying and quantifying analytes.
- Extract cleanup involved two additional steps which are recommended cleanup procedures in EPA Method 1613. First, the addition of 2,3,7,8-TCDD-³⁷Cl₄ as a recovery standard to each extract prior to any cleanup was used to evaluate the recovery of analytes through the cleanup procedures. Second, the addition of acid/base washing the extract prior to column cleanups. The acid/base wash is a routine step in both EPA Methods 8290 and 1613.
- Cleanup columns included acid/base silica, alumina, and AX21/celite as required in Method 23; however, amounts of column packing material and elution solvents were similar to those listed in EPA Method 1613 and varied slightly from Method 23 in some instances.
- The GC oven temperature program for separating analytes on a DB-5 column follows Method 1613, which varies somewhat from Method 23, but provides adequate separation of all analytes of interest.
- No second column confirmation of 2,3,7,8-TCDF on a DB-225 column was performed. The DB-5 column does not separate 2,3,7,8-TCDF from other TCDF isomers. As a result, values reported for 2,3,7,8-TCDF could include contributions from coeluting, non-2,3,7,8 isomers.
- No surrogate standards listed in Method 23 were added to the sampling trains before collecting field samples; therefore, the sampling train collection efficiency was not determined.
- Routine continuing calibration response factors for 2,3,4,7,8-PeCDF-¹³C₁₂ and 1,2,3,4,6,7,8-HpCDF-¹³C₁₂ were slightly outside the ± 30 percent limit from the initial calibration at the end of the analysis day on 10/11/93 and 10/12/93, respectively. Because of the very low level of analytes found in the samples, and because only two response factors out of a total of 33 native and recovery response factors were out of limits, the initial calibration was not repeated.

F-7. Analytical Protocol for Aldehydes

Gas samples (DNPH impinger solutions) and liquid process samples were analyzed for formaldehyde, acetaldehyde, acrolein, and propionaldehyde using high performance liquid chromatography with ultraviolet detection (HPLC/UV). Prior to the collection of the gas aldehydes, the DNPH reagent for the impinger samples was prepared by mixing 0.06 g of purified DNPH crystals per 250 mL of acetonitrile. Fifty (50) μ L of sulfuric acid was also added to each 250 mL of DNPH reagent.

After the gas samples had been collected and prior to analysis, the volume of DNPH impinger solution collected from each impinger was measured with a graduated cylinder.

Next, a 4-mL aliquot from each sample was transferred to a 4-mL HPLC sample vial with a septa-seal top. The HPLC vials were used as the permanent storage vessel for the impinger samples. These HPLC vials were refrigerated before and after analysis.

For liquid samples (both process liquid samples and condensed water samples from the gas sampling trains), all samples were reacted with DNPH just prior to analysis. An aliquot of 2 mL of each liquid sample and 2 mL of DNPH reagent were mixed in a 4-mL HPLC sample vial with septa-seal top. The HPLC vials were used as the permanent storage vessel for the liquid samples. The liquid-DNPH solutions were allowed to react for at least 3 hours prior to analysis. This reaction time is necessary to assure that all of the aldehyde species present in the liquid will be converted to carbonyl-DNPH derivatives. After the waiting period, the samples were analyzed. For the liquid samples, standards were prepared by adding the neat aldehydes to HPLC water at concentrations above and below those found in the actual samples. The standard water samples were reacted with the DNPH in the same manner as the actual samples.

For the process liquid samples, additional sample preparation steps had to be implemented because of the potential for suspended solids in the samples. Prior to reaction with the DNPH solution, the process liquid samples were filtered through a $0.22 \mu m$ filter.

After the liquid samples were reacted with the DNPH, a white precipitate settled out in a few of the samples. To protect the HPLC system, the liquid above the precipitate was decanted off and placed into a new HPLC vial. It was this liquid that was analyzed on the samples in which precipitation occurred.

All of the samples were analyzed with a Waters HPLC system. An acetonitrile/ H_2O mixture (65/35) serves as the mobile phase. Column flow is 0.8 mL/min. Typically, the injection volume used for aldehyde samples was 30 μ L.

F-8. Analytical Protocol for Radionuclides

Radiological analysis of both the gas (filter) samples and the solid samples was performed by the International Technology (IT) Corporation's Oak Ridge, Tennessee laboratory using a gamma scan method. The samples were prepared for gamma spectrometry using that laboratory's standard operating procedure OR-7003, Revision 0. Then the radioactivity counts were obtained using IT-Oak Ridge standard operating procedure OR-7212, Revision 0.

During the analysis procedures the following reports were prepared:

- (1) Gamma Spectroscopic Analysis Parameters
- (2) Summary of Positively Identified Nuclides
- (3) Summary of Unidentified Nuclides
- (4) Peak Search Report (Gross)
- (5) Peak Search Report (Net)
- (6) Summary of Nuclide Activity
- (7) Nuclide Line Activity Report
- (8) Full Combined Activity MDA Report
- (9) Unidentified Energy Lines Report
- (10) Total Uranium Analysis Parameters and Summary
- (11) Full Combined Uranium Activity MDA Report

For each sample the analysis results were summarized by reporting the activity in pico Curies per gram for the following isotopes as was called for in the QAPP:

Pb-210	Pb-211
Pb-212	Th-229
Ra-226	Th-230
Ra-228	U-234
Th-234	U-235

APPENDIX G UNCERTAINTY ANALYSIS

UNCERTAINTY ANALYSIS

An error analysis was conducted to provide an estimate of the uncertainty of the reported values for average emission factors. Emission factors on three days are reported in Section 6.2, along with the arithmetic average, \overline{E} . This Appendix describes the calculations done to estimate the total uncertainties in emission factors, shown as TU in the tables in Section 6.2. Daily emission factors were calculated by:

$$E_i = \frac{2.205 * g * (s+v)}{(HHV * cf)}$$
 (G-1)

where

 E_i = daily emission factor, $lb/10^{12}$ Btu

g = daily flue gas flow rate, Ncm/hr

s = daily solid phase concentration of substance in flue gas, $\mu g/Ncm$

 $v = daily vapor phase concentration of substance in flue gas, <math>\mu g/Ncm$

HHV = daily higher heating value of feed coal, Btu/lb

cf = coal feed rate, klb/hr

A goal of this project was to determine a representative value for E, the average emission factor for a substance from the power plant. The reported value of \overline{E} is an average from only three days of sampling. Daily variation in operation of the power plant contributes to uncertainty in the estimation of the long term average emission rates of substances.

G-1. Identification of Sources of Error

Two types of errors must be considered (ANSI/ASME PTC 19.1-1985, "Measurement Uncertainty", available from the American Society of Mechanical Engineers): random errors (or precision errors) and bias.

Three factors contribute to precision errors or variability in the reported daily emission factors. First, plant operating conditions change from day to day. Second,

variability in collecting samples leads to errors in determining the five parameters in equation G-1 that are used to calculate the estimate of E_i . Third, variability in analyzing the collected samples for s, v, and HHV leads to errors in estimating E_i .

Bias in determining E_i can result from systematic errors in determining any of the five parameters in equation G-1. Bias errors are assumed to be constant throughout the measurement process. They can be significant, known and accounted for in calibrations; insignificant, known, and ignored in the uncertainty analysis; or estimated and included in the uncertainty analysis. The bias, when included in an uncertainty analysis, is estimated as a upper limit of the bias error.

G-2. Procedures for Estimating Uncertainty

The error analysis for this project was designed to provide uncertainty intervals around the reported average emission factors of the form

Emission factor
$$(lb/10^{12} Btu) = \overline{E} \pm (U^2 + B^2)^{1/2}$$
 (G-2)

where

 \overline{E} = arithmetic average of the daily emission factors E_i

U = an approximate 95% confidence bound accounting for random errors

B = possible bias due to systematic errors.

Precision Errors

The 95% confidence bounds were calculated by

$$U = \frac{t*S}{\sqrt{3}}$$

where

t = 4.303, the upper 97.5 percentile of Student's t distribution with two degrees of freedom

S = standard deviation of the three daily emission factors.

Thus.

U = 2.48*S.

The resulting confidence level is approximately 95 percent. This assumes that the distribution of daily emission factors for each substance approximates a normal distribution.

Battelle evaluated whether or not to use propagation of error methods, such as those described in the ANSI/ASME document cited above, to determine the statistical uncertainty of the average emission factors. Propagation methods are often used to establish the uncertainty of a function of several measured input parameters. Battelle believes that the approach described above is preferred over propagation of error methods because the objective of this error analysis is to estimate the uncertainty of the average of independent determinations of daily emission factors. Computing the standard deviation of the E_i accounts for the three sources of variability cited above: day-to-day variations in plant operations, sampling error, and measurement error. The propagation of errors method is an approximate solution that will produce similar results, provided that the correlations among the input parameters are taken into account. For example, one would expect a high degree of correlation between the measured solid and vapor phase concentrations on each day and between the daily coal feed rates and flue gas flow rates.

Bias

The potential bias on E due to systematic errors in any of the five measured parameters in equation G-1 was calculated by

$$B = (\sum B_i^2)^{1/2} \tag{G-3}$$

where $B_j = dE_i/dp_j *\beta_j$ is the resulting bias in E_i caused by a systematic error of β_j in measuring parameter p_j (j=1-5 for g, s, v, HHV, and cf). These errors could not be specifically identified or confirmed; thus no correction was applied to the measured parameters. Battelle's estimates of the values of β_i are described below.

Flue gas flow rate. Determination of the flue gas flow rate, g, was assigned an upper limit of twelve percent for bias error. The bias for the gas flow measurement was

estimated by comparing measured gas flow rates to flow rates calculated from the coal feed rate and the oxygen content at the various sampling points. The average difference between the "measured" and calculated flue gas flow rates was 14 percent. This value was assigned to the parameter β_1 .

Solid phase concentrations. Solid phase concentrations, s, were calculated by dividing the quantity of a substance determined in the laboratory analysis of a sample by the flue gas volume associated with that sample. The amount of sample collected from the flue gas stream approximates the actual concentration. Potential bias in the quantity of collected material is summarized in Table G-1.

Sources of analytical bias (<u>Quality Assurance for Chemical Measurements</u>; Taylor, John Keenan; Lewis Publishers, Inc., Chelsea, Michigan, 1987) are listed in Table G-2 along with the estimate of the magnitude of the bias associated with each source. The estimates shown in Table G-2 were derived as follows:

Inefficiency Losses - Results for organic analyses are corrected for extraction recoveries. A bias of 2 percent is estimated for inorganic analyses based on matrix spike and SRM recovery results.

Calibration - For most organic and inorganic analytes, routine calibration results were required to be within ± 25 percent of initial calibration. Battelle's estimate of the bias in calibration is 5 percent.

Interference Resolution - The estimate of bias is zero because interferences are typically corrected for in organic and inorganic analyses or data are flagged as being affected by interference.

Contamination Gains - Data are corrected for contamination gains derived from field sampling, sample handling, and sample shipping by subtracting train blank results from sample data; therefore, the bias estimate is zero.

Instrumental Shifts - Instrumental shifts are considered to be corrected for by calibration bias; therefore the estimate is zero.

Matrix Effects - Matrix effects are evaluated by use of matrix spike samples. The estimate is zero because no consistent bias was detected in analysis of either inorganic or organic matrix spike samples.

Theoretical - Battelle's extensive experience with the inorganic and organic analyses conducted on this program has not detected any consistent bias based on theoretical effects; therefore the estimate is zero.

Operator Bias - Many of the analyses were conducted by different operators and no consistent bias was detected; therefore the estimate is zero.

Tolerance Adjustments - Based on Battelle's laboratory analysis experience, consistent bias with tolerance adjustments is nonexistent; therefore the estimate is zero.

Uncorrected Blank - Most sample results are corrected for laboratory method blanks and reagent blanks (where applicable) or blank results are negligible. Therefore the estimated bias from uncorrected blanks is zero.

Based upon these estimates, a bias error of five percent for organic solid phase determinations was estimated. Seven percent was estimated for inorganic solid phase determinations.

Considering both sampling and analysis together, the estimates of β_j for solid substances were computed as the square root of the sum of the squares of the individual bias estimates (see Table G-4).

<u>Vapor phase concentrations</u>. Vapor phase concentrations, v, were calculated by dividing the quantity of a substance determined in the laboratory analysis of a sample by the flue gas volume associated with that sample. The amount of sample collected from the flue gas stream approximates the actual concentration. Potential bias in the quantity of collected material is summarized in Table G-3.

Sources of analytical bias and associated bias estimates for vapor phase samples are the same are those listed in Table G-2 for solid phase samples except for the bias associated with the inefficiency losses for inorganic analyses. This bias is estimated to be 1 percent rather than 2 percent because the difficulty with preparing liquid phase samples for inorganic analysis is typically less than that for solid phase samples.

Combining the errors for sampling and analysis, Battelle estimated the β_j for vapor substances as shown in Table G-5.

Higher heating value of coal. The bias for the coal heating value determination was estimated at 2 percent. This estimate is based on the fact that the coal heating value is determined by a well-proven ASTM procedure by laboratories doing many samples daily. Additionally, utilities keep careful watch over their boiler efficiency and heat rate values. As the heating value is a major input to boiler efficiency and heat rate calculations, a bias as large as 2 percent would be obvious. Hence, a 2 percent bias estimate was assigned to the heating value determinations.

Coal feed rate. The bias for the coal feed rate measurement for the Niles Station Boiler No. 2 was estimated at 2 percent. This estimate was based on the fact that utilities, in general, keep careful watch over their fuel consumption and boiler efficiency. (The cost of fuel is typically 40 to 50 percent of the cost of generating electricity and, thus, is of major importance.) A bias as large as 2 percent in the fuel feed rate would be very obvious to the plant operators and action would be taken to correct any problem. Review of operations at Niles Station led to assignment of a value of 2 percent for β_5 .

Summary. The estimated upper limits for bias terms β_j are listed in Table G-6. Because of the uncertainty in estimating values for the β_j themselves, a decision was made to combine the values for β_2 and β_3 into one term. Therefore the values of $\beta_{2/3}$ were assigned as follows: elements - 7 percent, anions - 7 percent, radionuclides - 9 percent, particulate matter - 8 percent, SVOC - 7 percent, dioxins/furans - 7 percent, ammonia/cyanide - 6 percent, VOC - 8 percent, and aldehydes - 6 percent. Together with calculations of precision error, these terms were used to calculate the uncertainty intervals shown in tables of emission factors in Section 6.2.

G-3. Example Calculation

The following example calculation applies to calculating the uncertainty in the average emission factor for mercury.

Daily emission factors were calculated using Equation G-1:

$$E_1 = \frac{2.205 * 318,960 * 27.4}{12.269 * 91.5} = 17.1 \ lb/10^{12}Btu$$

$$E_2 = \frac{2.205 * 305,580 * 21.2}{12,108 * 94.2} = 12.5$$

$$E_3 = \frac{2.205 * 307,200 * 23.2}{11.892 * 96.7} = 13.7$$

The parameters used to calculate E₁, for July 27, 1993, are found as follows:

<u>Parameter</u>	<u>Value</u>	Where Found
g	318,960 Ncm/hr	Table 2-2 as 5,316 Ncm/min
s+v	$27.4 \mu g/Ncm$	Table 5-4
HHV	12,269 Btu/lb	Table 5-58
cf	91.5 klb/hr	Table 2-4

The average value \overline{E} was calculated as

$$\bar{E} = \frac{(17.1 + 12.5 + 13.7)}{3} = 14.4 \ lb/10^{12} \ Btu$$

The standard deviation, S, of the daily emission factors was calculated as

$$S = \sqrt{\frac{1}{(N-1)} \sum_{i=1}^{N} (E_i - \bar{E})^2}$$

$$= \sqrt{\frac{1}{2}[(17.1 - 14.4)^2 + (12.5 - 14.4)^2 + (13.7 - 14.4)^2]} \approx 2.39 \ lb/10^{12} \ Btu$$

The parameter U was calculated as

$$U = 2.48 * S = 2.48 * 2.39 = 5.93 lb/10^{12} Btu$$

The bias parameter B was calculated using Equation G-3. The $B_{\rm j}$ components were calculated as follows:

$$B_1 = \frac{dE}{dg} \beta_1$$

$$B_{2/3} = \frac{dE}{d(s+v)} \beta_{2/3}$$
 (j=2, s and j=3, v were combined)

$$B_4 = \frac{dE}{dHHV} \beta_4$$

$$B_5 = \frac{dE}{dcf} \beta_5$$

where E, g, (s+v), HHV, and cf are each the average value.

Now,

$$\frac{dE}{dg} = \frac{2.205 * (s+v)}{HHV * cf}$$
, j=1

$$\frac{dE}{d(s+v)} = \frac{2.205 * g}{HHV * cf}, j=2/3$$

$$\frac{dE}{dHHV} = \frac{-2.205 * g * (s+v)}{(HHV)^2 * cf}, j=4$$

$$\frac{dE}{dcf} = \frac{-2.205 * g * (s+v)}{HHV * cf^2}, j=5$$

From Table G-6, the β_j are:

$$\beta_1$$
 = 14% of g

$$\beta_{2/3} = 7\% \text{ of } (s+v) \qquad \text{(see text on page G-7)}$$

$$\beta_4 = 2\% \text{ of } HHV$$

$$\beta_5 = 2\% \text{ of } cf$$

The term B₁ was calculated as follows:

$$\frac{dE}{dg} = \frac{2.205 + 23.9}{12,089.67 + 94.13} = 4.63 \times 10^{-5} (lb/10^{12} Btu)/(Ncm/hr)$$

where (s+v) = average of daily values (Table 5-4)

=
$$(27.4 + 21.2 + 23.2)/3 = 23.9 \,\mu\text{g/Ncm}$$

HHV = average of coal heating values

$$= (12,269 + 12,108 + 11,892)/3 = 12,089.67$$
Btu/lb

cf = average of coal feed rate (Table 2-4)

$$= (91.5 + 94.2 + 96.7)/3 = 94.13 \text{ lb/hr}$$

therefore,

$$B_1 = 4.63 \times 10^{-5} * 0.14 * 310,580 = 2.02 lb/10^{12} Btu$$

where g = average of daily values (Table 2-2)

$$= (5,316 + 5,093 + 5,120) * 60/3 = 310,580 \text{ Ncm/hr}$$

Using the values above, the other components of bias were calculated in a similar manner, i.e.,

$$B_{2/3} = \frac{2.205 \times 310,580}{12.089.67 \times 94.13} \times 0.07 \times 23.9 = 1.01 \ lb/10^{12} \ Btu$$

$$B_4 = \frac{-2.205 * 310,580 * 23.9}{(12,089.67)^2 * 94.13} * 0.02 * 12,089.67 = -0.288 lb/10^{12} Btu$$

and

$$B_5 = \frac{-2.205 * 310,580 * 23.9}{12,089.67 * (94.13)^2} * 0.02 * 94.13 = -0.288 lb/10^{12} Btu$$

Then,

$$B = (2.02^2 + 1.01^2 + (-0.288)^2 + (-0.288)^2)^{1/2}$$

$$B = 2.29 \ lb/10^{12} \ Btu$$

Finally, the total uncertainty was calculated as

$$U = (5.93^2 + 2.29^2)^{1/2} = 6.36 \ lb/10^{12} \ Btu$$

TABLE G-1. BIAS ESTIMATES FOR FLUE GAS SAMPLING OF SOLID SUBSTANCES

Analyte Class	Estimated Bias (percent)	Source of Bias; Documentation
Elements Anions SVOC Dioxins/Furans Radionuclides Particulate Matter	5	Departure from isokinetic sampling; value is based on sampling data that show maximum departure of about 5 percent from isokinetic conditions. The bias for collection of solid phase material was assumed to be equal in magnitude to the departure from isokinetic conditions.
Elements Anions SVOC Dioxins/Furans Radionuclides Particulate Matter	2	Flow measurement error; required by Method regulations and maintained so by gas meter calibrations. Also consistent with RTI audits of Battelle's gas meters.
Elements SVOC Dioxins/Furans Particulate Matter	0	Loss of particulate matter in probe; value of zero results from recovery of particulate matter in probe wash.
Anions Radionuclides	5	Loss of particulate matter in probe; value is an estimate based on use of short probe, with no probe rinse. Consistent with losses of particles observed in long probe and flexible line.

TABLE G-2. BIAS ESTIMATES FOR LABORATORY ANALYSIS

Source of Bias ^(a)	Estimated F Organic ^(b)	Bias (percent) Inorganic ^(c)	
Inefficiency Losses	0	2 (solid) 1 (vapor)	
Calibration	5	5	
Interference Resolution	0	0	
Contamination Gains	0	0	
Instrumental Shifts	0	0	
Matrix Effects	0	0	
Theoretical	0	0	
Operator Bias	0	0	
Tolerance Adjustments	0	0	
Uncorrected Blank	0	0	

⁽a) <u>Ouality Assurance for Chemical Measurements</u>; Taylor, John Keenan; Lewis Publishers, Inc., Chelsea, Michigan, 1987.

⁽b) Organic analytes include SVOC, dioxins/furans, VOC, and aldehydes.

⁽c) Inorganic analytes include elements, anions, ammonia/cyanide, and radionuclides.

TABLE G-3. BIAS ESTIMATES FOR FLUE GAS SAMPLING OF VAPOR SUBSTANCES

. Analyte Class	Bias (percent)	Source of Bias; Documentation
Elements Ammonia/Cyanide Anions VOC SVOC Dioxins/Furans Aldehydes	2	Flow measurement error; required by Method regulations and maintained so by gas meter calibrations. Also consistent with RTI audits of Battelle's gas meters.
Elements Ammonia/Cyanide Anions Aldehydes	2	Completeness of collection in impinger solutions; based on experience with similar systems, including DNPH for aldehydes.
VOC SVOC Dioxins/Furans	5	Completeness of collection on solid sorbents; based on experience with similar systems, including XAD for PAH/SVOC.
Elements SVOC Dioxins/Furans	0	Loss in probe; value of zero results from recovery of probe wash.
Ammonia/Cyanide Anions VOC Aldehydes	2	Loss in probe; value is maximum likely value given elevated temperature of probe, but no probe wash.

TABLE G-4. CALCULATION OF BIAS ERROR TERMS (B₂) FOR SOLID PHASE SAMPLES

Substance	Sampling Bias ^(a) Errors (percent)	Analytical Bias ^(a) Errors (percent)	β ₂ ^(b) (percent)
Inorganic			
Elements	5,2	5,2	8
Anions	5,2,5	5,2	9
Radionuclides	5,2,5	5,2	9
Particulate Matter	5,2	5,2	8
Organic			
SVOC	5,2	5	7
Dioxins/Furans	5,2	5	7

⁽a) See text for origin of individual estimates.

TABLE G-5. CALCULATION OF BIAS ERROR TERMS (B₃) FOR VAPOR PHASE SAMPLES

Substance	Sampling Bias ^(a) (percent)	Analytical Bias ^(a) (percent)	β ₃ ^(b) (percent)
Inorganic	· • • • • • • • • • • • • • • • • • • •		
Elements	2,2	1,5	6
Anions	2,2,2	1,5	6
Ammonia/Cyanide	2,2,2	1,5	6
Organic			
SVOC	2,5	5	7
Dioxins/Furans	2,5	5	7
VOC	2,5,2	5	8
Aldehydes	2,2,2	5	6

⁽a) See text for origin of individual estimates.

⁽b) Computed as the square root of the sum of the squared error estimates for sampling and analysis.

⁽b) Computed as the square root of the sum of the squared error estimates for sampling and analysis.

TABLE G-6. ESTIMATED VALUES FOR BIAS TERMS IN THE UNCERTAINTY ANALYSIS

Parameter	Substance	Upper Limit Bias Term β_j (percent)
g		14
S	Elements Anions Radionuclides Particulate Matter SVOC	8 9 9 8 7
· v	Dioxins/Furans Elements	6
	Anions Ammonia/Cyanide SVOC Dioxins/Furans	6 6 7 7
HHV	VOC Aldehydes	8 6 2
cf		2